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PERITONITIS.

THE LETTSOMIAN LECTURES FOR 1894

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BY

FREDERICK TREVES, F.R.C.S.

Surgeon to, and Lecturer on Surgery at, the London Hospital;
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The first three Lectures are printed as they were delivered before the Medical Society of London. The fourth Lecture has been added in order to make the consideration of the subject more complete.

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PERITONITIS.

BY FREDERICK TREVES, F.R.C.S.
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Member of the Court of Examiners of the Royal College
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LECTURE I.

The Nature of Peritonitis.

I HAVE ventured to select peritonitis as the subject of these lectures, not only on account of the fact that the diseased conditions known by that name still occupy a terrible prominence among the causes of death, but because the present time, appears to be peculiarly convenient for reviewing the clinical and pathological aspects of this fatal trouble, and for criticising opinions, which the custom of years has endued with a spurious appearance of accuracy.

The nature of peritonitis.—By peritonitis is understood an inflammation of the peritoneum. From the limited standpoint of morbid anatomy no exception can be taken to this definition, but when it is assumed that the various clinical phenomena which are classed together under the title of "peritonitis" are due, either solely or in the main, to an inflammation of the great serous membrane, then the definition becomes to some extent misleading.

It may almost be said that peritonitis, clinically as well as pathologically, has comparatively little to do with inflammation of the peritoneum, and it would be erroneous to state that the majority of those who die of what is called peritonitis die of a peritoneal inflammation.

In order that this very fundamental matter may be fully discussed it is necessary that two questions should be considered. The first concerns itself with the general nature of inflammation, and the second with the relation peritonitis bears to that process.

(1) *The purpose of inflammation.*—If one may judge from the terms and expressions which are in common use respecting inflammation, and if deductions may be drawn from those ready criticisms of the process which are uttered without

fear of scientific cavillings, then inflammation is still the dread thing it was many centuries ago, when phlegmon was a ruthless fetish, and when the anti-phlogistic regimen was the only means of propitiation. Inflammation is still referred to as a calamity, as a thing that is violent, as an utter evil, and as an ill wind that can blow no other than ill. It is spoken of as "breaking out," and made comparable with a riot which lays waste a peaceful city. It is often said that the patient "did well until inflammation set in," or that "his progress towards recovery was cut short by a fatal attack of inflammation."

The treatment which should be directed against this evil is commonly assumed to be of the same heroic type as are the drastic measures which may be taken to arrest the progress of fire and pestilence. Inflammation was represented in the literature of the past as the great enemy of mankind, and even in the popular science of the present it retains no little of its satanic disposition.

This view of the inflammatory process needs to be amended, and a very brief survey of some examples of the process should quite justify such amendment. A man, let it be supposed, receives a lacerated wound of the hand in dissecting the body of a patient who has died of puerperal fever. He becomes thereby inoculated at the wounded point with what is practically a culture of pus producing cocci.

Now, as the human body is an excellent medium for the cultivation of bacteria, the micro-organisms begin forthwith to settle down and multiply. But here steps in the process of inflammation. Under its ægis the cells of the body rise in their millions against the invaders, and there takes place at the point of the outbreak a battle which—if the account of Metchnikoff and others is to be accepted—is without a parallel in the very deadliest warfare imagined by man.

It is by the inflammatory process that the poison is destroyed, and the growth of the parasite is arrested.

But for inflammation a man who is accidentally inoculated with a septic micro-organism becomes at once little more than a test-tube, prepared for the favourable development and culture of the particular coccus or bacterium. In malignant pustule can be well seen the desperate struggle which takes place in the tissues between the invading bacillus and the aroused and active cells of the body. This conflict is a representation of the inflammatory process, and the beneficent purpose of the change is splendidly obvious. But for this inflammation, which has been so much condemned, a human being may be regarded as an organism not far raised above the level of a peculiarly shaped mass of intelligent agar agar.

In a case of tuberculous phthisis it is generally assumed that a destructive inflammation of the lung is the chief cause leading to the patient's death. It is not the inflammation which is to blame but the bacillus which has caused it. How long it would take for the non-resisting lung to become wholly occupied by this particular bacterium it is impossible to say, but it is safe to assert that the inflammation of the lung prolongs the infected man's life, and that his prospects of improvement and recovery depend almost wholly upon it. How many lives and limbs have been saved for a reasonable span by that process in a joint called tuberculous disease, a process which after many centuries of unjust ignominy is now servilely imitated by the surgeon in his operation of arthrectomy. In the familiar "white swelling" is represented the often successful attempt of the organism to rid itself of the tubercle bacillus by means of the inflammatory process. In this, as in other invasions, the enemy is not repelled without loss, but it is the loss of a part as against the loss of the whole.

Inflammation is distinctly *not* a malignant energy working only for evil. It is a process with a purpose, and that a beneficent one. Its object is protective, and its end is shown by the freeing of the body of noxious organisms which lead to death, and upon which may well be bestowed the anathemas lavished on what is, in its primary purpose, a curative process.

The philanthropic busybody who, after contemplating the death-roll ascribed to inflammations of the lung and brain and kidney, could succeed in ridding the earth of the process of inflammation, would see a result which hardly a pessimist could regard as kindly. It may be assumed that within a month or so of the disappearance of inflammation from the business of the body the human race would become extinct.

That inflammation may be excessive in individual cases, that it may be attended by certain disasters, and that it may fail to some degree in its purpose, are evident facts. It is also clear that the process of inflammation may be assisted and modified by treatment, especially if it be in the direction of removing from the tissues those irritants which have not only caused but have maintained the inflamed state. Treatment having for its object the abrupt arrest of inflammation and the vigorous stamping out of its manifestations has not been attended with conspicuous success.

What has been said of inflammation in general applies equally to inflammation within the great serous cavity of the abdomen. Peritoneal inflammation is not a purposeless calamity. That which has caused it is the thing which is wholly ill. It is by the process of inflammation that the advance of certain deadly irritants, which have gained access to the cavity, can be arrested. The purpose of peritonitis is towards the saving of life and not towards the destruction of it. What is seen within the abdomen at the autopsy on a case of peritonitis represents the results of an attempt on the part of the organism to avert a too potent cause of death. It does not represent, as is too commonly assumed, the reckless and fanatical destruction wrought by a wholly evil-tending process.

(2) *The relation of peritonitis to the inflammatory process.*—In the larger proportion of examples of fatal peritonitis the leading symptoms are those of poisoning and not of inflamma-

tion, and death is due rather to toxæmia than to inflammation of the serous membrane. This view of the subject was advanced by Wegner[1] nearly twenty years ago.

There is about the patient who is dying of peritonitis every suggestion of a poisoned man. He lies back in bed prostrate, with gaunt cheeks and sunken eyes. There is a look of unceasing anxiousness in his face, and a sense of hopeless unquiet in his movements. The hands, which wander with pathetic restlessness over the bedclothes, are cold and damp. The tongue is that of a man who is dying of thirst. There is constant vomiting. The breathing is laboured, and accompanied with faint sighs and groans, and the countenance is ashen and livid. Such a picture makes a reality of the metaphor of "the shadow of death." So far as the aspect of the patient goes, he might be dying from snake bite or from the poison of cholera, while there is little to suggest an inflammation so intense as to be ending fatally in a few distressful days.

When the patient dies and the abdomen is opened, the amount of inflammation discovered is out of all proportion to the phenomena which preceded death. In one case there may be merely some injection of the peritoneum with loss of its polished surface, and in its place a general stickiness and a few frail and insignificant adhesions. In another, there may be an ounce or so of thin greenish pus around the cæcum, an exudation looking ill-conditioned enough to the surgical eye, but still a mere scanty mixture of pus and turbid fluid, and not the kind of formidable effusion which would be expected in a case of death from inflammation.

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[1] *Arch. für Klin. Chir.*, 1876.

As a matter of fact, the contrast between the phenomena before death and the degree of inflammation found afterwards, may be still more marked, as the following case will show.

A woman of 62 came into the London Hospital with a femoral hernia which had been strangulated four days. Herniotomy was at once performed; some omentum was removed, and the purple coloured gut was reduced. For the rest of the day and during the day after the patient vomited with little cessation, her abdomen became swollen and painful, her pulse failed, and her strength declined. She passed into the condition already described, and on the morning of the third day she died. Throughout the temperature had never risen as high as 99°. The autopsy revealed an operation without a flaw, and an abdominal cavity showing no morbid change but a faint injection and a fainter dulling of the lower districts of the peritoneum.

Such a case may be rightly described, in accordance with ancient usage, as one of death from peritonitis, but it can hardly be spoken of as death from inflammation.

A further aspect of the case may be illustrated by sundry experiments upon animals.

If a certain dose of a particular septic matter be introduced into the peritoneal cavity of an animal, peritonitis follows, of which the animal dies in three or four days, and there is found at the autopsy the characteristic changes in the serous membrane. If a smaller dose of the same poison be used, symptoms of peritonitis follow, from which the animal may recover with or without the previous development of an encysted intra-abdominal abscess. If a larger dose be employed, the animal may die within twenty-four or thirty hours with symptoms which are at least suggestive of peritonitis, and yet exhibit after death a peritoneum either devoid of any evidences of inflammation or displaying the most insignificant changes.

A similar order of circumstances would appear to hold good in the human subject. In some of the most rapid cases of death after such a lesion as is known to be capable of causing peritonitis, no inflammatory changes are found within the abdomen. The patient is said to have died of shock, and the cause of that shock would appear in the majority of instances to be due to the profound nerve irritation caused by the sudden spreading of noxious micro-organisms or their products over a wide and sensitive surface. In the next series of cases the patient lives for three or four days, he exhibits the features of acute peritonitis, and after death the serous membrane is found to show but the early manifestations of inflammation. In other instances recovery follows after a more or less desperate illness, and this may be effected with or without the development of encysted suppuration.

In the human subject, as in the laboratory experiments, it must be remembered that where the question of sepsis is concerned, not only must the dose be considered, but also the power of resistance of the individual.

In further support of the statement that in the larger proportion of examples of fatal peritonitis the leading symptoms are those of poisoning and not of inflammation, and that death is due rather to toxæmia than to inflammation of the serous membrane, the following points may be adduced.

It is noteworthy that the cases in which suppuration is the most pronounced, are among the most favourable examples of peritonitis, and that on the other hand the most acute and unfavourable cases are found with those which show the least inflammatory changes.

I shall have to refer later on to a collection of 100 cases of peritonitis obtained from the records of the London Hospital. Out of this number 70 died. If there be excluded from these fatal cases 13 in which the cause of the peritonitis was either never discovered or was due to cancer or tuberculosis, there remain 57 examples of death. In only 15 of these was the exudation found to be purulent; in 11 it was described as sero-purulent; in the remaining 31 examples there was no suggestion of pus. This is hardly what would be expected in a disease the leading phenomena of which are inflammatory.

In not a few instances of puerperal peritonitis, the cases, if regarded pathologically, are merely examples of septicæmia in the most ordinary sense. In addition to the usual constitutional signs of that condition, there are certain local symptoms which indicate a disturbance within the peritoneum.

For example, a woman, aged 31, developed some three weeks after her confinement the signs of peritonitis. She died in four days. During that time she continued to vomit, although not severely, and in those four days she had three well-marked rigors, and her temperature ranged from 100 to 105. So apparent was it that there was some peritoneal effusion that an exploratory puncture of the abdomen was made on the day before death, but without result. The autopsy revealed some localised non-suppurative peritonitis around the uterus, which was fixed. The general peritoneum was quite sound. There was commencing pleurisy of the left side.

Then again, the surgical treatment of acute diffused peritonitis as a purely inflammatory affection has not been very successful, and has indeed been comparatively unsuccessful.

This treatment consists of incision and the evacuation of the effusion. It answers admirably in suppurative inflammation of the pleura, and in cases of localised purulent peritonitis, as met with in the pelvis and about the cæcum, and in the tuberculous variety, but in the form of peritonitis now under consideration it is comparatively useless.

It may be also incidentally mentioned that the mortality attending the operation for strangulated hernia, does not appear—except in connection with umbilical hernia—to have been greatly improved since the introduction of aseptic measures in surgery. These measures, if complete, are assumed to reduce the risks of inflammation in an operation like herniotomy to a minimum.

But even in cases in which neither gangrene nor perforation of the gut occurs, it is evident that there is something besides mere inflammation which is leading to death.

It must not be assumed in a contrary direction that inflammatory phenomena are wholly subordinate in peritonitis.

In many instances such as those consequent upon troubles in the pelvis or in the vermiform appendix, the signs of inflammation are paramount. There may be an initial rigor, the fever is high, the pain and tenderness are intense, and the production of aggressive pus is often early and vigorous. Moreover, in tuberculous peritonitis the leading symptoms more usually belong to the category of chronic inflammation, and the patient not infrequently dies of suppuration and its consequences. One cannot avoid repeating that these cases represent the more favourable aspects of peritonitis, and that they respond well to those general operative measures which are applicable to inflammation.

In concluding this part of the subject, it is only fair to say that other views of the mode of death in peritonitis are held by many competent authorities, and in illustration of this I cannot do better than refer to the very thoughtful and original monograph on this subject by Dr. John

Malcolm,[1] who contends that to nervous disturbances must be referred many of the conditions which have just been discussed.

The peculiarities of the peritoneum.—It is obvious that there are phenomena attending a lesion of the peritoneum which a reference to like disturbances in other serous membranes cannot explain.

Both pleuræ may be violently inflamed, and that inflammation may run on to suppuration, and yet the condition has not the gravity of a case of peritonitis in which the evidences of inflammation may be slight, and in which the exudation, if collected, may only amount to a few ounces of sero-purulent fluid. Even when the necessary allowance is made for the greatly different extent of surface in the two cavities, an explanation of the differences in the relative prospects of death is not forthcoming. It will be said that the gravity of the two cases depends, not upon a damage to the serous membranes, but upon a resulting disturbance of function in the viscera they cover. From this point of view peritonitis may be considered to be more aptly compared with inflammation of the meninges of the brain. But even this comparison is not entirely satisfactory. That death must follow a gross interference with the functions of the brain is obvious, but it is not so evident that those who die of peritonitis die because the functions of the abdominal viscera are gravely disturbed. We do not encounter in peritonitis such fatal functional disturbances as suppression of bile or suppression of urine. In a case of acute peritonitis ending in death in four days we have, for that time the following evidences of abdominal disorder. There is constant pain, and frequent vomiting, and absolute constipation, and the ingestion of no food. But a patient may be in pain for four days, and may be starved for four days, and may vomit for four days, and have no action of the bowels for four days, and yet live. So far as functional disturbance of the viscera within the belly is concerned, it is safe to say that in many cases of severe lead poisoning which end in recovery, the visceral disorders are more considerable than they are in some examples of peritonitis which end fatally in a few days.

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[1] *Medical Society's Transactions*, vol. xvi., 1893, p. 188.

Then, again, septic matter often finds its way into the pleural cavity. It is true that serious symptoms may follow, but they are by no means of necessity fatal, and are certainly not to be compared in gravity and deadliness with the results of introducing a part of the same septic matter into the peritoneal cavity.

The following points may be noted with regard to the peritoneum :—

(1) Its surface is very considerable and is probably, as Wegner[1] states, as great as that represented by the whole integument of the body.

(2) The membrane possesses remarkable powers of absorption, as shown by the manner in which milk, blood, peptones, &c., are taken up. It is said to be capable of absorbing an amount equal to from 3 to 8 per cent. of the body weight. It is noticed that septic intoxication occurs quicker in peritoneal infection than in any other. Dirt, pus, fæcal matter are more dangerous to life when introduced into the peritoneal sac than when brought into contact with any other like cavity.

(3) The peritoneum offers a limited resistance to septic organisms and their products. Experiments upon animals and clinical experience in man show that it can safely dispose of a certain quantity of septic germs. The precise process by which this is effected is a matter of some doubt. There is evidence to show that the resistance of the peritoneum varies within wide

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[1] *Verhand. d. Deutsch. Gesell. für Chirurgie*, Berlin, 1877.

limits, and is affected by age, and by such enfeebling disorders as chronic liver or kidney disease. The peritoneum of the rabbit appears to be remarkably sensitive to sepsis, whereas that of the dog has comparatively high powers of resistance.

The intestinal mucous membrane affords an infinitely less sensitive medium for septic infection than does the serous covering of the bowel.

(4) No tissue in the body provides more favourable conditions for healing than does the peritoneum.

(5) The peritoneum does not show the same degree of vulnerability in all parts, nor are all portions of it alike in the manner in which certain lesions are responded to.

The part which is apparently most sensitive to infection, and which is most prone to rapidly spreading and diffuse inflammation, is that which covers the small intestine.

The parietal peritoneum has certainly not so high a degree of susceptibility, and is not so apt to assume the diffuse and low form of inflammation.

The morbid changes in peritonitis are more marked and more advanced on the visceral layers and omentum than upon the parietal part of the membrane, and this circumstance is not always to be accounted for by the point of origin of the trouble.

Terillon[1] showed that the effect of irritation of the peritoneum is comparatively feeble over the parietal layer or over the liver, while it is violent and intense when the membrane covering the intestines is involved.

Localised forms of peritonitis and encysted exudations are comparatively uncommon in the large area occupied by the small intestine.

Localised peritonitis is met with in those regions which are more or less unoccupied by the coils of the lesser bowel, viz., in the subphrenic district between the dome of the diaphragm above and the transverse colon below, in the region of the cæcum, and especially in the outer side of that region, and lastly in the pelvis. If a list be drawn up of cases of peritonitis which have either been recovered from spontaneously or have been relieved by operation, the great majority will be in one or other of these three districts. It is certain that localised purulent collections are uncommon except in these situations. It is remarkable, moreover, what extensive progress peritoneal inflammation may make in the region of the liver or within the pelvis without inducing very alarming symptoms, and it is interesting also to note how wholesome is the type of the inflammation in many cases, and how substantial are the adhesions produced. Of the localised troubles in the cæcal region, the same can only be said in a modified degree.

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[1] *Progrès Médical*, 1883, p. 645.

The fatality of injuries of the intestine is well known, and the attendant peritonitis spreads like a fire. Lesions of the liver and of the bile passages are, on the other hand, often followed by a peritonitis which is slow and moderate, and which may end in recovery.

In making these comparisons it must not be forgotten that in the bowel lesion there will be greater opportunities for septic infection than in the case of a limited injury to the biliary passages, although in many instances of death from wound of the gut there has been no appreciable extravasation of its contents.

Mickulicz[1] speaks of the transverse colon as if it were a barrier to prevent the spread of peritonitis downwards, and suggests that the comparatively simple character of pelvic peritonitis may be due to the dependent position of the pelvic basin.

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[1] *Deutsche Gesellschaft für Chirurgie*, 1889, p. 303.

(6) The peritoneum appears to be possessed of great sensitiveness—a matter of moment in the production of shock. This sensibility is evidently peculiar and is not quite comparable to that possessed by the skin. Certainly the peritoneum does not feel pain as does the skin.

The twisting of a hernial sac and the securing of it with a tight ligature is seldom followed by much distress, and yet the same process carried out on integument of equal extent would assuredly be attended by considerable nerve disturbance.

The pain which may accompany the injecting of a large hydrocele with iodine is noteworthy.

The handling of perfectly normal peritoneum is attended with more or less distress in conscious patients. This is illustrated in iliac colotomy performed without anæsthesia, in the reduction of prolapsed coils of intestine covered with unaltered peritoneum, and especially in the removal of gauze tampons.

I have several times had occasion—especially in operations upon the liver—to place a tampon of iodoform gauze upon normal peritoneum, and the removal of this within twenty-four hours is intensely painful. On one occasion a portion of unaltered omentum escaped with the plug, and the replacement of that tissue caused great distress.

When the surface of the serous membrane has become inflamed and covered with lymph, the ordinary sensibility appears to be dulled or lost. This is noticed in the decrease of pain and tenderness which is not uncommon as a plastic peritonitis advances, and also by the fact that in iliac colotomy or gastrostomy carried out in two stages, the cutting of the gut or of the stomach when once it has become covered with lymph, is more or less entirely painless.

The irritant which of all others appears to affect the peritoneum the most acutely, is that represented by the invasion of the surface by certain bacteria or by their products.

The disproportion between the intensity of the pain and the comparatively small area of infection, is often to be well seen in cases of disease of the vermiform appendix.

(7) One matter of great interest, although of some obscurity, concerns the condition of pressure within the abdominal area, and the effects which follow upon the disturbance of it.

It has been many times pointed out that there is no cavity of the abdomen, and that the term, the sac of the peritoneum, is a misnomer. "Every practical anatomist," wrote Benjamin Travers nearly a century ago, "has a familiar illustration of the non-existence of an abdominal cavity in the operation of laying open the abdomen."[1]

In performing laparotomy, the surgeon is constantly reminded that he is cutting into a vacuum and is exposing what is merely a potential cavity. This appears to be more noticeable when the operation is quickly done. I have the impression that when the serous membrane is fully exposed and yet undivided, air may pass through it into the potential space. Some invisible damage may have been wrought by the forceps in some of the more striking instances. Sometimes, especially in a child, a loop of gut may be seen through the peritoneum to be lying in the very closest contact with it. A minute prick is made, and the gut seems to fall away from the membrane and a cavity is revealed.

One would imagine that the disturbance of pressure relations of this kind, could not be without effect upon the sensitive tissues and thin walled blood vessels within the abdominal parietes. The effect of a mere incision into the abdomen is often entirely remarkable. In not a few cases of tuberculous peritonitis a simple laparotomy has been performed, the fluid within the abdomen has been allowed to escape, and the wound has been hastily closed. Yet to the surprise of the operator this elementary proceeding has been followed by complete cure.[1] Aldibert[2] reports the case of a child in whom a simple laparotomy was followed by the disappearance of numerous tuberculous mesenteric glands discovered at the operation. What explanation is there to give?

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[1] "An Inquiry into the Repairing of Injuries of the Intestines," London, 1812, p. 8.

The examples in which complete and quite unexpected relief of abdominal troubles has followed the mere opening of the peritoneal space are numerous. Many remarkable instances have been collected by Professor William White, of Philadelphia, in an interesting paper on the curative effect of operations *per se.*[3] If all those cases of cure by simple incision be excluded in which a neurosis may have been the foundation of the trouble, there still remain many instances in which the assumption is very strong, that considerable physical changes within the abdomen must attend the mere opening of the cavity. Two such instances are afforded by the following cases.

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[1] Spencer Wells, "Diseases of the Ovaries," 1865, p. 331.

[2] "De la Laparot. dans la Periton. Tub.," Paris, 1892.

[3] *Annals of Surgery*, August and September, 1891.

A middle-aged man had all the symptoms of stricture of the pylorus, and was suffering considerable distress. There was some doubt as to the cause of the stenosis. I opened the abdomen, discovered a malignant growth of the stomach and closed the wound immediately. The parts were in no way disturbed. The patient at once improved, the vomiting ceased and the dilatation of the stomach diminished. The improvement was maintained for no less a period than six weeks, and before the completion of that time the patient had returned to his easy duties as a gate porter. In due course all the symptoms reappeared, and the case followed the ordinary course of cancer of the pylorus.

The second case was one of suppurative pylephlebitis, and represents—so far as I can ascertain—the only instance in which this grave condition has been treated by operation. The case was under the care of Dr. Frederick Parsons, of Wimbledon, to whom I am indebted for permission to publish this brief preliminary account. The patient was a young lady of 15, who was attacked on September 17, 1892, with typhlitis. There was a previous history of constipation and of indiscretions in diet. The symptoms were severe, and in spite of prompt treatment by rest, opium, hot fomentations and enemata, continued to pursue an acute course. On September 24, the patient had a severe rigor. From this date until October 17, she went from bad to worse. Her temperature ranged from 97.6 to 105. She had a very severe rigor almost every day, but not with any definite regularity. The abdomen remained painful, tender and distended, the vomiting was distressing, the wasting was rapid and delirium supervened. On September 29, pain was first experienced in the back on the right side and just below the last rib. Later on, tenderness was noticed over the liver, and that organ became considerably enlarged. There was at no time jaundice or ascites.

The case had certain points of resemblance to malarial fever, and the account of suppurative pylephlebitis given with much detail in Pepper's "System of Practical Medicine," may have been founded upon this individual case.[1] The patient was seen by Sir William Broadbent, and it was advised that an exploratory incision should be made over the liver. This I carried out on October 17.

The following conditions were revealed. There was no peritonitis; there were a few adhesions about the cæcum; the appendix was normal. The gall bladder contained about half an ounce of bile. The liver was greatly and evenly enlarged, and was as soft as a lung. It was dotted all over—so far as its surface could be exposed—with minute yellow specks which were of the size of a hole made with an ordinary pin. These specks could be seen but not felt. On actual measurement three were counted in one square inch. After having made the inspection I closed the abdomen. From this day forth the child made an uninterrupted recovery, the rigors were never repeated, the vomiting ceased and the temperature gradually sank to normal. She is now in perfect health. The case shows that typhlitis does not always depend upon mischief in the appendix, but that it may be due, as was apparently the cause in this instance, to a stercoral ulcer in the cæcum. Dr. Bartholow, the writer in Pepper's "System of Medicine," states that "the most frequently occurring cause of pylephlebitis is ulceration and suppuration of some part of the intestinal tube, and hence the most common result is multiple abscess of the liver." Another sentence from the same monograph may be added. "The termination is death, doubtless invariably."

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[1] Vol. ii., p. 1097, London, 1885. See also accounts by Dr. Bradbury, *Medical Times and Gazette*, September 27, 1884; Dr. Bristowe, *Transactions of Pathological Society of London*, vol. ix., p. 278; and M. Chauffard, *Traité de Médecine*, by Charcot, Bouchard and Brissaud, t. iii., Paris, 1892.

I cannot help thinking that an explanation of this different result will be forthcoming when something more is known of the pressure conditions within the abdomen.

There are certain other points in connection with intra-peritoneal pressure which remain to be mentioned. In the first place, gravity does not appear to follow the usual lines within the abdomen. One would expect that any effusion which is free within the cavity of the belly would find its way into the pelvis as the most dependent part, and that this would take place even in patients who are lying in bed. It is quite obvious that adhesions must much influence this matter. At the same time, the great frequency with which this action of gravity appears to be inoperative, or at least imperfect, is so marked as to call for some explanation. In the second place, the frequency with which escape of fæces fails to take place in spontaneous perforation of the intestine and in punctured wounds of that viscus is somewhat remarkable. Travers[1] lays especial stress upon this, and gives several illustrative cases. He is of opinion that the explanation is to be found in the state of pressure within the abdomen.

Zeigler[2] states that in fifteen cases of laparotomy for wound of the intestine, fæcal extravasation was found to have taken place in six instances only. He also considers that this is to be accounted for by pressure, and alludes to the observation of Klemm,[3] who asserts that the idea that the wound in the bowel is blocked up by prolapsed mucous membrane is fallacious.

(8) The last point concerns the possibility of the peritoneum acquiring some degree of immunity from septic infection.

It has been shown by Reichel[4] and others that in dogs an immunity from peritoneal infection from pyogenic cocci can be produced artificially. A small dose of septic material is introduced into the abdominal cavity, and after the animal has recovered from the disturbance produced a large dose is injected. This process is repeated at intervals with increasing amounts of the poison until at last no symptoms are induced by an amount which in a control experiment would cause death within twenty-four to thirty-six hours.

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[1] *Loc. cit.*, pages 16-18, *et seq.*

[2] " Uber die intestinale Form der Peritonitis," Munich, 1893.

[3] *Deutsche Zeit. für Chir.*, 1892.

[4] *Deutsche Zeit. für Chir.*, bd. xxx., p. 1.

A not unlike invulnerability appears to be possible in the human subject. Other things being equal, an operation carried out within the abdomen of a person who has had chronic peritonitis, or who has exhibited repeated sub-acute attacks, and whose peritoneum presents substantial adhesions, is likely to be attended with better results than when the peritoneum is found to be wholly undisturbed. In the operation for removal of the vermiform appendix in cases of relapsing typhlitis, the little disturbance which follows extensive procedures occupying as long as one and a-half hours can, I think, only be explained by an immunity acquired by the peritoneum after repeated attacks of inflammation. Moreover, in advanced cases the disproportion which is often noted between the constitutional disturbance and the local condition discovered at the operation appears to be capable only of the same explanation.

I have reported[1] the case of a woman with a fæcal fistula, due to the destructive suppuration of a dermoid cyst of the ovary. I opened the abdomen for the purpose of closing the fistula. The tract led down to a hole in the sigmoid flexure, which was firmly fixed in the left iliac fossa. As the bowel could not be brought to the surface, and as the opening could not be sutured *in situ*, there was nothing to be done but to leave it and to pack the area between the hole in the bowel and the parietal wound with iodoform gauze. Very extensive adhesions existed, and for some twelve months previously there had been a smouldering peritonitis. The patient did well, and the good result was probably to no small extent due to the immunity the peritoneum had acquired during the twelve months of inflammatory turmoil.

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[1] *Lancet*, June 10, 1893, p. 1376.

In looking over the records of laparotomy performed for perforations in the stomach or bowel, it is impossible not to be struck with the fact that in many of the successful cases there had been long antecedent visceral or peritoneal trouble.[1]

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[1] Note Cases by Kriege, *Berlin. klin. Wochen.*, 1892.

LECTURE II.

The Causes of Peritonitis.

OF the many classifications of peritonitis which have been attempted, those are the most satisfactory in which the etiology has been taken as a basis. Even when this method of division has been regarded, there is no disease which has been broken up into more varieties or burdened with more differentiation than has the affection under consideration.

In the very elaborate monograph on peritonitis by Spillmann and Ganzinotty,[1] no less than twenty-six different forms of the disease are described, and even these are subjected to many and complex sub-divisions.

Every addition to our knowledge of inflammation of the great serous membrane tends to make the classification of its various forms more and more simple.

It has now become evident that peritonitis depends almost entirely, if not entirely, upon infective processes, and that these agencies are concerned, directly or indirectly, in every form of the disease.

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[1] "Dict. Encyclo. des Sc. Mèd.," Paris, 1887.

There are those who maintain that there is no form of peritonitis which is not due to infection, and although the data upon which such an assertion is based are not entirely perfect, there is yet much presumptive evidence in favour of its accuracy. Indeed, the domain of non-infective peritonitis is becoming rapidly more and more dubious.

In dealing with any classification in which an infective process is the main element there are many general considerations to be borne in mind. On the one hand there is the dose of the poison, and on the other hand there is the soil into which it is introduced. The dose must obviously be liable to considerable variations, not only in amount but also in virulence, while the conditions offered for growth by the inoculated body must differ to even a wider and more complex extent.

The resistance of the individual to the growth of septic organisms is influenced by a multitude of circumstances, the value of which is scarcely susceptible of being formulated. There are questions of age and of health, and of such unfavourable affections as Bright's disease, diabetes and alcoholism. There are local conditions which lend themselves to the more ready cultivation of germs, such as extensive damage to the peritoneum, and extensive interference with its functions of absorption—or, at least, with that ill-understood power it possesses of dealing with noxious micro-organisms. There are the presence of ascites, and the co-existence of extravasations of blood, bile or intestinal matter in the peritoneal cavity. There is, finally, the entirely undefined peculiarity of the individual which appears to alone render one man susceptible and another almost exempt.

In the great majority of instances peritonitis depends upon what Tavel and Lanz[1] call "continuity infection." By this is understood the direct spreading of the infection to the peritoneum from a neighbouring tissue other than the serous membrane. Under such heading would be included peritonitis following hernia or any visceral lesion or disease capable of producing the trouble, puerperal peritonitis, most forms of pelvic peritonitis, and certain varieties of tuberculous peritonitis. It would exclude the larger number of the cases of inflammation of the serous membrane which follow accidental or operation wounds.

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[1] "Uber die Ætiologie der Peritonitis," Basel, 1893.

With peritonitis due to infection by continuity must be included what is conveniently termed by the authors just named "chemical peritonitis." Here the peritoneum is invaded not so much by the micro-organisms themselves as by their chemical products. The serous membrane may absorb these products from adjacent tissues, for in a few examples of peritonitis no micro-organisms have been discovered in the exudation after careful examination by competent observers.

The following Classification of peritonitis according to its cause appears to be justified by our present knowledge of the subject.

(1) *Peritonitis due to infection from the intestine.* — Under this heading are included most cases of peritonitis associated with hernia, with intestinal obstruction, and with perforation ; peritonitis due to any form of ulceration of the bowel ; to enteritis ; to cancerous growths of the gut and to troubles in the appendix. There will also be included peritonitis due to inflammatory changes in the biliary canals, and some forms of peritonitis following upon operation.

The micro-organism which is usually found associated with these different forms of peritonitis is the bacterium coli commune.

(2) *Peritonitis due to infection from without.*—This division will include puerperal peritonitis, peritonitis consequent upon inflammatory troubles in the genital organs or in the parietes of the abdomen, and some forms of peritonitis following upon operation.

The micro-organisms usually associated with the varieties considered under this heading are pyogenic cocci, and notably the streptococcus pyogenes.

(3) *Peritonitis due to the pneumococcus.*

(4) *Tuberculous peritonitis.*

(5) *Peritonitis of a doubtful nature.*—Under this purposely indefinite heading it will be convenient to discuss—(*a*) Peritonitis due to irritants; (*b*) forms of the trouble reputed to depend upon rheumatism, gonorrhœa, syphilis, Bright's disease and alcoholism; and (*c*) peritonitis met with in the newly born.

In order to form an approximate idea of the relative frequency of different forms of peritonitis two tables are appended. The first is an analysis of 100 cases of peritonitis taken from the records of the London Hospital. The only test applied in the selection of these cases

TABLE I.

PERITONITIS.	Number of Cases.	Sex.		Average Age.	Result.		Time of Death.					Exudation in Fatal Cases.					Vomiting absent or very slight.	Bowels loose.
		Males.	Females.		Deaths.	Recoveries.	In 36 hours.	In 48 hours.	3rd to 4th day.	5th to 7th day.	After 7th day.	Commencing.	Plastic.	Serous.	Sero-purulent.	Purulent.		
With hernia	10	3	7	52	10	0	0	0	6	2	2	3	3	0	3	1	2	2
With perforation of bowel ...	9	4	5	40	9	0	4	2	0	2	1	2	3	1	1	2	2	3
With gross disease of bowel ...	6	4	2	40	6	0	3	0	0	2	1	1	2	1	2	0	2	3
With disease of appendix ...	22	19	3	22	6	16	0	0	0	5	1	0	1	1	1	3	4	4
Starting from lesions about the pelvis	18	5	13	36	11	7	3	1	1	6	0	3	1	0	2	5	2	6
Following abdominal wounds ...	14	2	12	36	14	0	0	1	5	5	3	2	6	1	2	3	5	4
By extension from the pleura ...	1	0	1	32	1	0	0	0	1	0	0	0	0	0	0	1	0	0
Tuberculous	8	2	6	20	5	3	0	0	0	1	4	0	2	3	1	0	3	4
Diffuse cancer of peritoneum ...	2	2	0	42	2	0	0	0	0	0	2	0	0	2	0	0	1	0
Causes of peritonitis unknown ...	10	2	8	29	6	4	0	0	1	0	5	0	3	3	0	0	2	2
	100	43	57		70	30	10	4	14	23	19	11	21	12	12	15	23	28

was evidence that the clinical details and the accounts of the autopsy (in the fatal examples) were as complete as possible. The latter accounts are from the *Pathologists' Reports.* The clinical details in the 100 cases are practically complete as regards temperature, account of vomiting, state of the bowels, pulse, respirations, &c., and in the majority of instances a daily statement of the patient's symptoms is given. For the making of this laborious collection of cases I am indebted to Mr. A. Hallidie, F.R.C.S.

The second table is from the monographs by Fränkel (*Wien. klin. Wochen.*, Nos. 13-15, 1891), and Tavel and Lanz (*loc. cit.*).

TABLE II.

Cases of peritonitis in man in which micro-organisms were found in the exudation.

	Fränkel.	Tavel and Lanz.	
	Found alone.	Found alone.	In Association.
Bacterium coli commune... ...	11	15	16
Streptococcus	7	3	15
Staphylococcus	1	2	6
Pneumococcus	1	0	2
	20	20	39

(1) *Peritonitis due to infection from the intestine.* — As already stated the micro-organism which appears to be usually answerable for the numerous forms of peritonitis met with under this heading is the bacterium coli commune-

This most remarkable and common bacillus was first described by Escherich[1] in 1885. Its definite pathogenic properties remained imperfectly recognised until 1889, when they were expounded by Laruelle,[2] by Roux and Rodet,[3] and many others.

Within the last few years the literature appropriated to this little organism has become so extensive as to be almost overwhelming.[4]

The morphology of the bacillus—with which we have no concern in this place—has been elaborately dealt with by Wurtz,[5] Macaigne, and other writers.

It has been shown to be identical with the bacillus pyogenes fœtidus obtained by Passet in 1885, from the stinking pus of a peri-rectal abscess.

It has been proved to be the same microorganism as the bacillus lactis ærogenes, and the pyogenic urinary bacterium, described by Clado and Albarran in 1891.[1]

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[1] *Fortschritte d. Med.*, 1885.

[2] "Etude bactér. sur les Periton. par perforation," *La Cellule*, 1889, vol. 5.

[3] *Lyon Médical*, 1889.

[4] One of the most valuable monographs is "Le Bact. Coli Commune, son Role dans la Pathologie," by Dr. Macaigne. Paris, 1892. Another good general account is by Malvoz (*Arch. de Med. Exper.*, 1891, p. 593), and another by Welch (*Trans. Congress of American Phys. and Surg.*, vol. 2).

[5] *Archiv. de Méd. Exper. et d'Anatom. Pathol.*, January 1, 1893.

In many particulars it closely resembles the bacillus of typhoid, but the distinguishing features of the two micro-organisms have been fully pointed out by Trambusti,[2] Péré,[3] and Wurtz.[4]

The bacterium coli commune exists normally in the human body, and is found in individuals in a state of perfect health. It has been demonstrated to be present along the whole length of the alimentary canal from the mouth to the anus.[5] Its natural habitat is the bowel. It is said to be especially numerous in the duodenum[6] and in the colon, and has been found in the bile passages.

It is certainly the most abundant and the most constant of the bacteria found normally in the human body, and has been estimated to form 95 per cent. of the micro-organisms met with in the bowel of man. Sternberg[7] gives a list of forty-eight micro-organisms which have been isolated from human fæces or the contents of the intestine. Of this number twenty-five are non-pathogenic, and of the pathogenic forms not a few represent the same bacillus under different names. There is no doubt that special names have been given to micro-organisms which are mere variations of one common form.

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[1] *Compt. rend. Soc. de Biol.*, 1891, p. 830.

[2] *Centralb. f. Allgem. Path.*, May 1, 1892.

[3] *Annales de l'Institut Pasteur*, July 25, 1892.

[4] *Archiv. de Méd. Exper. et d'Anat. Path.*, January 1, 1893.

[5] Vignal. *Arch. de Phys. Norm. et Path.*, 1886-87.

[6] See, however, on this point Gessner. "Uber die Bakt. im Duod.," *Arch. für Hygiene*, bd. ix., p. 128.

[7] *Manual of Bacteriology*, New York, 1892. Booker isolated twenty-one different kinds of bacteria from the contents of the small bowel in cases of diarrhœa.

This matter is well dealt with in the excellent monograph by Tavel and Lanz,[1] a work which forms by far the most important recent contribution to the subject of the etiology of peritonitis. Tavel and Lanz regard the term bacterium coli commune as a generic term applicable to an extraordinarily numerous family of bacteria. They themselves indicate some twenty varieties in this great family. These authors also have pointed out that the colon bacillus is sometimes mobile and possessed of cilia, and sometimes immobile. They do not, however, associate any pathogenic differences with these two forms, which they have admirably figured.

The bacterium coli commune has a striking feature in that it appears to vary in virulence.

So far as experiments upon animals are of value it would seem to be quite harmless when taken from the normal intestine. A culture of the bacillus so obtained has no effect when injected into the peritoneum of animals.[1]

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[1] "Uber die Ætiologie der Peritonitis," Basel, 1893.

If, however, the bowel become the seat of certain diseased conditions (or it may almost be said of *any* diseased condition), then the bacillus becomes at once virulent.

Virulence has been found to be developed in cases in which the bowel was obstructed, strangulated or inflamed, in venous congestion of the gut, in œdema of the bowel wall, in diarrhœa, in typhoid fever and in cholera.

In a case of diarrhœa produced by tartar emetic, this colon bacillus was found to have become virulent.[2]

It also appears to develop qualities for evil in instances of advanced constipation.

In any case experiments show that the virulence when once developed may vary considerably in degree.

Tavel and Lanz describe an interesting case of localised abscess due to mischief in the vermiform appendix. The pus was swarming with the colon bacillus. Quantities of the same bacillus were found in the peritoneum, but there was no peritonitis. Much gas was discovered in the peritoneal cavity.

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[1] Le Sage and Macaigne, *Archiv. de Méd. Exper.*, 1892, vol. iv., p. 350.

[2] Fränkel, *loc. cit.*; Macaigne, *loc. cit.*

When the intestine is healthy, the bacterium coli commune has little disposition to escape through the gut wall or to invade the tissues of the body after death. If, however, the intestine be damaged or diseased, then the bacterium shows an active inclination to penetrate through the bowel wall, and is usually found to have extensively invaded the tissues after death.[1] The disposition of the bacillus to pass through the intestinal wall under the circumstances just stated, is well illustrated in examples of slight degrees of strangulation of the bowel produced by experiment in animals.[2]

The effect of injecting a culture of the virulent colon bacillus into the peritoneum of animals varies—other things being equal—according to the dose. In the slightest cases the animal, after an illness in which diarrhœa is a symptom, recovers. In another grade a localised purulent peritonitis is produced which follows a chronic course. In a third degree death is rapidly brought about by a diffuse fibro-purulent peritonitis. In instances in which a large dose is employed, the animal dies of acute sepsis before any phenomena of peritonitis are produced.

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[1] Paul Ziegler. "Uber die intest. Form der Peritonitis," Munich, 1893.

[2] Arndt, *Centralb. f. Bakt.*, 1893, xiii., p. 173.

It may here be noted that when peritonitis *is* produced, it is usually purulent.

The presence of fluid in the peritoneum and especially of blood, greatly aids the development of peritonitis in these experiments.[1] The activity also of the bacillus is much increased, if it be injected with sterilised fluid from the intestine as a medium. If a sterile saline solution be used the effect is diminished.[2]

It may be mentioned that the endothelial cells of the peritoneum do not appear to act as phagocytes, for in various experiments in which the colon bacillus was injected into the peritoneal cavity, it was never once found by Ziegler within these cells.

It has been clearly demonstrated that the bacterium coli commune can produce pus after inoculation. It has been found in man in a state of almost pure culture in the pus from an ischio-rectal abscess.

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[1] Ziegler, *loc. cit.*

[2] Laruelle, "La Cellule," 1889, vol. 5.

So far as the human subject is concerned, it has been shown that these various forms of peritonitis which are assumed to be of intestinal origin, depend mainly and in many instances solely upon the bacterium coli commune.

In peritonitis associated with hernia, the colon bacillus is the micro-organism most commonly found in the sac. This is the case in all stages of strangulation, and is independent of the character of the fluid, the bacilli being obtained in cases in which the fluid in the sac is copious and opaque, as well as in those in which it is clear and scanty.

In fifteen examples of hernia Bönnecken[1] found the bacterium coli in the sac in thirteen instances.

The bacillus so commonly found in the hernial sac by Clado[2] in 1889, is now known to have been the colon bacillus.

Tavel and Lanz examined bacteriologically the exudation in the sac, or in the adjacent peritoneum in twenty-one cases of strangulated hernia, in two cases of "hernial hydrocele," and in one case of suppuration of the sac. In eighteen instances they discovered no micro-organisms of any kind In five examples—including three in which the gut was apparently not involved in the rupture—bacteria were found, the most common being the bacterium coli commune. The authors consider the cases unassociated with micro-organisms to be examples of "chemical peritonitis," and to be due to the products of bacteria rather than to the germs themselves; they do not, however, commit themselves to the opinion that the bacillus chiefly concerned is that now under consideration.

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[1] *Virch. Arch.*, vol. 120, p. 7.

[2] *Congress de Chirurgie*, 1889.

Laruelle[1] has demonstrated the bacterium coli commune in gangrenous hernia, and in gangrene of the gut produced artificially in animals.

Arndt[2] has shown by a series of most carefully conducted experiments that micro-organisms can pass through the gut wall into the peritoneal cavity, when the strangulation is of quite a slight grade, and is very far short of producing even a limited gangrene.

Bönnecken's[3] investigations give practically the same result.

Cornil[4] found bacteria actually in the substance of the wall of a partly necrosed intestine.

Tavel and Lanz are of opinion that while micro-organisms cannot pass through the wall of healthy bowel, they are very ready to escape if the gut be the seat of even a slight lesion.

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[1] "La Cellule," 1889.

[2] *Centralb. für Bakt.*, 1893, xiii., p. 173.

[3] *Loc. cit.*

[4] *Archiv. de Méd. exper.*, t., i., p. 353.

It is only fair to say that Orth's[1] experiments do not support these very widely held opinions.

Macaigne gives an account of thirty-five cases of peritonitis of intestinal origin, in which the colon bacillus was the only organism present, or at least the principal one.

These thirty-five cases are distributed as follows :—

With troubles in the appendix ...	10 cases
With typhoid fever	9 ,,
With ulcerative enteritis	6 ,,
With perforation	3 ,,
With cancer of colon	3 ,,
With hernia	2 ,,
With thrombosis of mesenteric vessels	1 ,,
With ulceration of gall bladder ...	1 ,,
Total	35 ,,

The researches of Welch, Ziegler, Fränkel and Malvoz all bear in the same direction.

The colon bacillus has been shown by Cornil, Babes and others, to be almost exclusively the bacterium concerned in perforative peritonitis.

Barbacci[2] states also that it is practically the only bacillus to be produced in cultures from the exudation in perforative peritonitis in man. The same applies to perforative peritonitis produced experimentally in dogs. In this form of peritoneal inflammation, the other micro-organisms found in fæces develop in the serous cavity but only for a time. The bacterium coli commune alone survives. Barbacci points out that the liberal development of this bacillus is greatly favoured by the presence of such a medium as is provided by the fluid contents of the intestine, a material which readily damages the peritoneal endothelium. He considers that death is due to absorption partly of the bacterial products, and partly of the noxious chemical matters contained in the intestinal fluid which escapes into the belly cavity.

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[1] *Central. für Chirurg.*, 1889, p. 849.

[2] *Central. f. Path. ù Path. Anat.*, October 12, 1893.

In the same way it has been demonstrated that this micro-organism is the active agent in the majority of cases of peritonitis starting from the appendix.

Adenot[1] gives four cases of so-called appendicitis attended with suppuration, in the pus of which the colon bacillus was found in a pure culture. In another instance in the exudation upon the surface of a non-perforated appendix containing a concretion, this bacillus was the only micro-organism found.

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[1] *Compt. Rend. de la Soc. de Biologie*, 1891, iii., p. 740. See also cases of Roswell Park, "Annals of Surgery," September, 1893, p. 310.

Tavel and Lanz in the valuable work already quoted deal with twenty-three cases of trouble in the appendix. An examination was made either of the pus within or without the appendix, or of the exudation into the peritoneal cavity immediately around the diseased process. The material for this bacteriological examination was obtained during the patient's life. In three instances no micro-organism was found. In nineteen examples the colon bacillus was found either alone or in association with other pathogenic germs. The streptococcus was found in several cases; the pneumococcus was met with in two examples, but not in pure culture. The staphylococcus pyogenes citreus was in one instance the only micro-organism discovered.

Tavel and Lanz give five cases of internal strangulation of the bowel, and one case of resection of the gut. In three of these the colon bacillus was found in the exudation of the peritonitis which resulted.

One of the five cases affords a good example of "chemical peritonitis." The patient, aged

40, had symptoms of intestinal obstruction. Laparotomy was performed on the seventh day. Strangulation by an omentum band was discovered. There was general peritonitis. The abdomen was drained. The fluid escaping from the drainage-tube proved to be sterile on cultivation. The patient recovered.

Bignami, Bastianelli,[2] Le Sage, and Macaigne[3] have shown that in suppurative or ulcerative troubles of the gall bladder or biliary passages the bacterium coli commune is often the only bacterium found. Roswell Park[4] has also furnished a case illustrative of this association.

In three examples of peritonitis following suppurative inflammation of the gall bladder, Tavel and Lanz found the bacterium coli commune in two instances and pyogenic cocci in the third.

This bacillus has also been found in cases of peritonitis following operation, and on this subject Dr. Welch writes as follows[5] :—"Its presence several times in pure culture, in laparotomy

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[1] *Boll. della R. Acad. med. di Roma*, 1891, F. iv. and v.

[2] *Ibid.*, F. vii.

[3] *Arch. de Med. Exp.*, 1892, vol. 4, p. 350.

[4] *Annals of Surgery*, Sept., 1893, p. 311.

[5] *Trans. Congress of American Phys. and Surgeons*, vol. 2.

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wounds treated aseptically, although apparently not a source of serious trouble, was not a matter of indifference. It was generally accompanied with moderate fever, and a thin, brownish, slightly purulent discharge, of somewhat offensive but not putrefactive odour. The smooth and rapid healing of the wound was interfered with. In some of the cases there was evidence of intestinal disorder."

In the cases of peritonitis after laparotomy in which the colon bacillus is found, it is probable that such an injury had been inflicted upon the intestinal peritoneum at the operation as to permit the bacterium to escape through the bowel wall. It has been shown that it requires but little damage to the bowel or to its serous covering to allow of such escape.

It is well known that pneumonia is not an uncommon sequel of peritonitis, and it is possible that in certain of these cases the colon bacillus is the active agent.

It has been found in the pleura when pleurisy was present (Laruelle), and has been obtained by puncture from the hepatised lung some days before death from peritonitis (Macaigne). Fisher and Levy give two cases of strangulated hernia with pulmonary complications, and in both instances the colon bacillus was found in the affected parts of the lung.[1]

Finally, it has been assumed that some of the constitutional symptoms attending severe constipation may be due to the absorption of the products of this widely diffused bacillus.

The exudation associated with the bacterium coli commune when it attacks the peritoneum is often characteristic. It is well seen in cases of inflammation about the appendix. The fluid is at first clear and greenish-looking. It then becomes greenish yellow, thin, semi-opaque, and foul smelling. If it pass on to suppuration, the pus has no especial characters except that it is frequently offensive. In chronic cases there is sometimes produced a white, soft custard-like material which is often met with in operations upon the appendix during a quiescent period, and which I do not think is changed pus nor a residuum left by pus. In some long-standing cases I have scraped away a full teaspoonful of this matter from about the cæcum.

In concluding the account of this variety of peritonitis it may be pointed out that the irritant which induces the peritonitis, and which reaches

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[1] *Deutsch. Zeit. f. Chir.*, 1891.

it from the intestine may follow more than one path. (*a*) Bacteria may escape through a perforation in the bowel; (*b*) they may pass through the wall of a segment of intestine which has been in some degree damaged, but not perforated; and (*c*) chemical products of bacteria may reach the peritoneum by either one of these routes.

(2) *Peritonitis due to infection from without.*—It has been already observed that this variety of peritonitis usually depends upon pyogenic cocci. Of these the streptococcus is the one most usually met with. It is often alone, or it may be found in association with other micro-organisms, among which, however, it is the chief.

That the streptococcus is the usual agent in puerperal peritonitis has been shown by Widal, Bumm, Fränkel, and Courtois-Suffit.[1] It has been met with in association with putrefactive bacteria in examples of perforative peritonitis by Predœhl and others.

The staphylococcus is very rarely met with alone in cases of peritonitis, and is usually associated with the more virulent form of coccus. (See Table II.)

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[1] *Gaz. des Hôpitaux*, Nov., 1890. *Munchen. med. Wochen.* 1889, No. 42.

So far as experiments go it has been shown that injections of pyogenic cocci into the peritoneum act more vigorously if mixed with a fluid difficult of absorption, or if introduced with a corrosive fluid capable of damaging the peritoneal endothelium.

In twenty instances reported by Pawlowsky,[1] in which the staphylococcus was introduced into the abdomen of animals, death followed in eighteen cases from purulent or hæmorrhagic peritonitis. A drop, or even half a drop, of fluid from a case of puerperal peritonitis may kill an animal when injected into the abdomen, whereas in a control experiment a syringeful of the exudation from an example of peritonitis after operation may not lead to a fatal result.

The pyogenic cocci, and most usually the streptococci, have been met with in cases of peritonitis after operation in man, and experiments upon animals show how the noxious effect of those micro-organisms may be assisted by extravasations in the peritoneal cavity, by long exposure of the peritoneum, and by damage to its delicate surface.

In the operation cases it is most probable that the streptococcus gains an entrance through the wound. In puerperal peritonitis it, no doubt, reaches the abdomen through the pelvic organs following the veins or lymphatics, or the Fallopian tube.

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[1] *Central. f. klin. Chir.*, 1888.

In the rare examples of peritonitis associated with erysipelas of distant parts (such as the face) the streptococcus must be assumed to reach the serous membrane through the blood.[1]

(3) *Peritonitis due to the pneumococcus.*—This variety of peritonitis has not yet been so soundly demonstrated as to possess an indisputable existence. In the first place, the connection of the pneumococcus with pneumonia is a subject about which there is much conflicting evidence. In the second place, peritonitis is a very rare sequela to pneumonia, although it is true that pneumonia is not an uncommon complication of peritonitis.

The pneumococcus has been found in the peritoneum in a large number of the subjects of fatal pneumonia, and yet the serous membrane has remained sound. In 151 autopsies in which the pneumococcus was demonstrated Netter[2] found only two cases of peritonitis.

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[1] See case by Cheurlin, *These de Paris*, 1879.

[2] *Soc. Med. des Hôp.*, May 22, 1890.

However, cases of peritonitis have been reported by Weichselbaum,[1] Courtois-Suffit,[2] Sevestre,[3] Nélaton,[4] and Galliard,[5] in which the pneumococcus appears without doubt to have been the cause of the inflammation.

The peritonitis in some of these cases was primary, and was the sole disease, in the other instances it was secondary to ordinary pneumonia.

The pneumococcus would seem to be at one time noxious to the peritoneum, and at other times to be harmless.

It is difficult to localise it in the peritoneum of animals by experiment.

Cultures obtained from the exudation in certain instances of peritonitis in which the pneumococcus was the only micro-organism found and injected into animals caused death from general sepsis.

Morisse,[6] whose monograph on this subject is by far the most complete, has collected eight examples of peritonitis in which, and in the associated lesions, the pneumococcus was the only micro-organism found. In seven of these there was either pneumonia or pleurisy. The exudation was purulent in five, and sero-fibrinous in three. Six of the patients died and two recovered In both of these laparotomy had been performed.

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[1] *Central. für Bakt.*, Jan., 1889.

[2] *Soc. Méd. des Hôpit.*, April, 1890.

[3] *Ibid.*, May, 1890.

[4] *Bull. Méd.*, Oct., 1890.

[5] *Soc. Méd. des. Hôp.*, Nov., 1890.

[6] "Pértonite a Pneumococcus," Paris, 1892. See also an excellent article by Boulay, "Des Affections à Pneumococcus independent de la Pneum." Paris, 1891.

(4) *Tuberculous peritonitis.*—This variety of peritonitis is dealt with in Lecture IV.

(5) *Peritonitis of a doubtful nature.*—(*a*) Peritonitis due to irritants. On the subject of this form of peritonitis there is much conflict in opinion. If its existence be established, then the existence of a non-infective variety of peritonitis has to be at once acknowledged.

Bumm[1] maintains that a non-infective peritonitis may be produced by mechanical, chemical or thermal irritants, and states that it is usually plastic and localised.

Pawlowsky injected sterilised croton oil into the abdomens of twelve animals. Of this number eight died from hæmorrhagic peritonitis, and neither pus nor micro-organisms were found in the exudation, nor were there any signs of sepsis.

As a comment upon these experiments, it may be noted that pyogenic cocci (*e.g.*, the staphylococcus aureus) will act more readily, and in smaller doses if introduced into the peritoneum together with some corrosive fluid capable of injuring the serous endothelium, and further that such injury to the peritoneal surface—in cases in which no cocci are injected—encourages the escape of the colon bacillus from the intestine.

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[1] *Munchener med. Wochens.*, No. 42, 1889.

Fränkel injected Tr. iodi and Liq. ferri perchlor. into the peritoneum of certain animals. Peritonitis followed. If the exudation were examined at an early stage, or in the slightest cases, it was found to be clear and free from micro-organisms. If, however, the case were advanced, the exudation was purulent and swarming with bacteria which had passed through the bowel wall.

A like explanation would appear to be adapted to an experiment by Thompson,[1] who found that a piece of wadding dipped in 1 in 1,000 solution of corrosive sublimate and placed within the abdomen caused in some animals a fatal peritonitis.

Jalaguier[2] showed that tampons of sterilised gauze introduced into the peritoneal cavity of dogs caused no symptoms and no reaction, and when the animals were killed at the end of some months the gauze was found rolled up in a ball and encapsuled by adhesions. It was made evident, moreover, that it needed a foreign body of a certain size to even excite adhesions.

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[1] *Central. f. Gyn.*, January 31, 1891.

[2] *Gaz. Hebdom.*, 1892, p. 161. See also a case by Michaux, *Bull. et Mem. Soc. de Chir.*, April, 1893.

Fæces, if introduced into the peritoneal cavity, cause peritonitis, not by chemical action, nor as an irritant, but by reason of the micro-organisms or their products contained in the extravasation.[1] If the material be sterilised no effect follows. Fresh filtered fluid from the bowel caused, when injected into the abdomen, a fatal peritonitis in the exudation of which the bacterium coli commune was found. The same fluid when filtered through many layers of gauze produced abdominal symptoms, but all the animals lived. When the fluid was sterilised it had no effect.

The same results have attended the injection of human bile into an animal's peritoneum. When the bile was untreated peritonitis usually followed, but when it was sterilised the injection was attended by no evil results.

According to Naunyn,[2] normal bile is sterile.

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[1] Ziegler, Pawlowsky, Reichel, and others.

[2] *Deutsche med. Woch.*, 1891, No. 5.

According to Létienne,[1] it may contain bacteria. It is said by others to be sterile so long as it contains free biliary acid.

In inflammatory conditions of the bile passages the bacterium coli commune is commonly found.

Lähr,[2] has shown that in man a considerable effusion of bile may take place into the peritoneal cavity without causing peritonitis.

Blood is not of itself capable of producing peritonitis, although it affords a very favourable condition for the development of any bacteria which may gain access to the extravasation.

This fact may be considered to be proved by the experiments of Penzoldt,[3] Cornil and Ranvier,[4] and others, and by the operation of peritoneal transfusion of blood performed on man by Ponfick,[5] Golgi and Raggi.[6]

Orth[7] believes that it is possible to set up peritonitis by injecting a large quantity of blood into the cavity. He considers that it induces inflammation not so much through the action of bacteria as through the development of some fibrin ferment. Mr. Herbert Page,[1] has published three very interesting cases of peritonitis from hæmorrhage, but it is evident from the reports that the peritonitis was of very slight degree and of very secondary importance.

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[1] *Arch. de Méd. exper.*, t. iii., p. 761.

[2] *Schmidt's Jahrb.*, 1890, t. iii., p. 235.

[3] *Deutsch. Arch. f. klin. Med.*, 1876.

[4] *Soc. de Biol.*, 1871.

[5] *Berl. klin. Woch.*, 1879.

[6] *Gaz. des Hôp.*, 1880.

[7] *Centralblatt für Chir.*, 1889, p. 849.

A consideration of the whole matter leads to the conclusion that the production of peritonitis by non-infective irritants has not yet been satisfactorily proved.

(*b*) Spillmann and Ganzinotty,[2] have collected fifteen recorded cases of rheumatic peritonitis with nine deaths. In some of these cases the peritonitis appeared alone, in others in association with rheumatic troubles in the joints, or in other serous membranes.

The evidence, however, upon which the pathological assumption depends is by no means satisfactory and will not stand a critical examination.

Peritonitis has been met with in association with gonorrhœa, but inasmuch as the gonococcus will not survive in the peritoneal cavity, it is to be assumed that pyogenic cocci have found a nidus in the discharge from the genitals and have spread by extension to the peritoneum.

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[1] *Trans. Clin. Soc. Lond.*, vol. xxv., 1892, p. 172.

[2] "Dict. Encyclop. des Sc. Med.," Article "Peritonitis," Paris, 1887.

Interesting articles on this subject have been published by Horowitz,[1] Menge,[2] and Wertheim.[3]

The peritonitis reputed to be due to Bright's disease, to alcoholism and to syphilis, has not been shown to have a specific etiological existence. It would seem rather to occur under conditions which are very favourable to bacterial growth, or to be due to extension from parts which are already inflamed. The subject is fully dealt with in the monograph by Spillmann and Ganzinotty, to which reference has already been made.

(*c*) The peritonitis met with in the newly born appears to be due to one of two conditions. It may depend upon puerperal infection, and be brought about by direct extension from the cord, which is found to be inflamed, or gangrenous, or the seat of an actually erysipelatous condition. Or it may be due primarily to the giving way of the bowel in cases of imperforate anus, or to that rupture of the normal sigmoid flexure which has been assumed by Zillner,[1] and Generisch,[2] to be due to direct pressure on the bowel during parturition.

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[1] *Wien. med. Wochens.*, 1892, No. 2.

[2] *Zeits. für Geburts. und Gynäkol.*, 1891, xxi., p. 19.

[3] *Central. für Gynäkol.*, 1892, No. 20.

For some fuller account of non-infective and of chronic non-tubercular peritonitis reference may be made to special articles by Schroeder,[3] and Strumpel.[4]

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[1] *Virch. Archiv.*, bd. 96, p. 307.

[2] *Ibid.*, bd. 126, p. 485.

[3] *Zeitschrift für Geburt. und Gyn.*, 1886, p. 493.

[4] *Gen. Path.*, Leipsig, 1885.

LECTURE III.

The Clinical Features and Treatment of Peritonitis.

THE CLINICAL FEATURES.—The general symptoms of peritonitis are so well known, and have been so precisely described, that they call for no special consideration in the present lectures. It will be necessary only to deal with the characteristics of certain individual symptoms, and to define the clinical peculiarities of certain varieties of peritoneal inflammation.

(1) *The nervous phenomena.* — The general arrangement of the nerve supply of the parietes of the abdomen and of the abdominal viscera, is somewhat peculiar. The skin over the greater part of the abdomen, over that part at least beneath which lie the chief viscera, is supplied by the lower seven dorsal or intercostal nerves.

The same nerves supply the muscles of the belly, viz., the rectus, the two oblique muscles and the transversalis.

More than that, these identical nerves take a most important part in the nerve supply of the abdominal viscera and of the peritoneum.

There are certain great nerve centres within the belly, with which the sympathetic is conspicuously concerned, and from which the organs of the abdomen are supplied.

The chief of these centres are the solar, the cœliac and the superior mesenteric plexuses, and it is most noteworthy that the contribution they receive from the spinal nerves is derived in whole or in greater part from the lower seven dorsal nerves through the splanchnics.

It is further to be observed, that these particular spinal nerves are concerned in the movements of respiration, since they supply the lower series of intercostal muscles.

It thus happens that an arrangement exists for the most rapid possible conduction of reflex impulses. A cold hand is laid upon the abdomen, or a blow upon the part is threatened, and the muscles of the belly wall become rigid in a moment, or it may be that there is some sudden lesion of the peritoneum or of one of the abdominal viscera, and at once the muscles of the belly wall contract, and a more or less marked hyperæsthesia of the skin develops, and there is thus provided, by the tender integument and by the rigid muscles, that protection and that securing of rest which are the first elements in the natural treatment of a damaged part.

Absolute rigidity of the belly, a limitation of the abdominal respiratory movements, and a tenderness of the surface are among the very earliest symptoms of acute trouble within the abdomen. The tenderness of the belly wall is often excessive, and depends upon an actual hyperæsthesia of the surface rather than upon a tenderness within the abdomen. In some cases the hyperæsthesia is so extreme that the patient cannot bear the touch of the lightest hand, and is even afraid to allow the bedclothes to come in contact with the skin of the abdomen.

The rigidity of the belly and the sensitiveness of the surface vary within considerable limits, and are most marked in cases which are sudden and acute, and especially in those in which the peritoneum at the time of the outbreak was perfectly normal. The nerve condition of the individual has also to be taken into account. In chronic cases, in cases complicated with ascites and in instances in which a sudden trouble falls upon a peritoneum which has long been exposed to irritation, the phenomena may be little marked.

In certain examples of perforative peritonitis the contraction of the belly wall may be so extreme that the parietes sink in and appear almost as if resting upon the spine.[1] This great retraction of the belly is comparable with that sometimes met with in lead colic. It has been for the most part noticed in connection with perforation of the stomach.

As peritonitis advances, both the hyperæsthesia of the skin and the contraction of the belly wall lessen and may almost entirely pass away. As the muscles yield, the phenomena of meteorism usually appear, and any tenseness of the abdomen which remains, depends upon flatulent distension of the intestines. As soon as general septic symptoms become marked, both the contraction and the tenderness usually disappear. I have seen two cases of septic peritonitis due to trouble in the appendix, run their entire course with a flaccid belly wall, and with scarcely any tenderness. Both patients were men over 50, no morphia had been administered, and death took place from toxæmia within seven days in both instances. One man spent some hours in applying massage to his own abdomen, and the other drew frequent attention to the absence of tenderness by slapping the abdominal wall.

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[1] Rullier, *Arch. Gen. de Méd.*, t. ii., 1823, p. 380. Ebstein, *Zeit. für Klin. Med.*, band ix., 1885, p. 209.

That pain which the patient feels to be actually situated within the abdomen has the peculiarity that it is not as a rule to be localised at first, but is commonly referred to the great abdominal nerve centres. In the early stages of strangulated hernia or of perityphlitis, for example, the patient very often refers the pain to the region above the umbilicus, and will sometimes place his hand or his finger exactly over the site of the solar or superior mesenteric plexus. I have known the pain in perityphlitis to be referred at first to the opposite or sound side. As symptoms progress the localisation of the pain becomes usually more and more precise, assuming that the trouble still remains, to a certain extent, local. A patient who has had many attacks of perityphlitis gives a very hazy account of the situation of the pain in the first outbreak, but as time advances he often puts his finger directly over the diseased appendix. I have noticed the same phenomenon in intestinal troubles due to limited adhesions. The pain may be at first "all over," or be referred to the median line a little above the umbilicus. In due course, however, it becomes more and more accurately localised.[1]

Into the great question of the physiology of peritoneal shock I have no intention of entering. Certain symptoms which are collectively known as the phenomena of shock, mark, almost without exception, the clinical beginnings of those cases of peritonitis which are abrupt in their onset or acute or even sub-acute in their course. These symptoms are evidently entirely due to an impression upon the nervous system, and are independent of inflammation on the one hand or of septic intoxication on the other. Certain experiments by Reynier and Richel[2] may be mentioned as illustrative of this statement. They injected boiling water into the peritoneal cavity of a rabbit. The phenomena of shock were at once produced, the temperature sank to 29° C. and the animal died, collapsed, within twenty-four hours. The more extensive the scald the more marked was the shock. In no case was any peritonitis produced. The injecting of perchloride of iron led to like results. There was no pulmonary congestion, and no formation of clot in the heart, and no peritonitis. If before the injection a nerve sedative, such as chloral, was administered to the animal it would live for twenty-four hours instead of dying at the end of six or ten hours.

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[1] See some cases by Lauenstein. *Archiv. für klin. Chir.*, 1892, p. 120.

[2] *Comptes Rendus*, 1880, p. 1220.

In the human subject the shock attending a severe peritoneal lesion may prove fatal, and the patient may die with evidence of no important disturbance other than that wrought directly through the great nerve centres. The signs of sudden and grave disturbance of the peritoneum are—pain, profound exhaustion, a distressful anxiety, pallor, a small, soft, quick pulse, cold extremities, shallow respiration and vomiting. These phenomena vary in degree, and are not absolutely invariable. They often mark the earliest symptoms of an acute and suddenly produced peritonitis, or rather indicate the occurrence of a lesion which will lead on to peritonitis. It is interesting to note that these symptoms are, in some degree, common to *all* cases in which there has been a rude and abrupt impression made upon the nerve centres within the abdomen. It may almost be said that all quite acute troubles within the abdomen commence with the same train of symptoms. A student who is well versed in the rigidly formulated signs of abdominal lesions as given in text books is surprised to be told that until many hours have elapsed it is often impossible to say whether a sudden abdominal crisis is due to the perforation of a vermiform appendix or to the bursting of a pyo-salpinx, or to the strangulation of a loop of intestine, or to the passage of a gall stone. The twisting of the pedicle of an ovarian cyst has led to symptoms which have been mistaken for perityphlitis, a sudden peritoneal hæmorrhage has been confused with intestinal obstruction, and the rupture of a hydatid cyst has been diagnosed as a perforation of the intestine. It is quite possible—indeed, quite usual—for these various troubles to present at first symptoms which are common to them all, and which merely indicate that a shock has been communicated to the great abdominal nervous system. Often at first there are no differentiating symptoms. There may be features in the past history of the patient which indicate a diagnosis, but in the absence of such evidence the cautious surgeon is simply assured that some sudden emergency has occurred within the peritoneal area, and that he must wait for localising signs before he can offer a diagnosis. To these common phenomena of a crisis within the abdomen Gübler[1] has applied the convenient term of "peritonism."

In the symptoms which are associated with an actually advanced peritonitis it is quite evident that the nervous system plays a prominent part. A study of intestinal neuroses makes it easy to appreciate how important that part may be. Not only may colic and diarrhœa occur in instances in which there is no reason to suspect any actual intestinal lesion, but there are cases, more or less clearly proved to be neurotic, in which there were meteorism, fæculent vomiting and even some signs of strangulation.[2] I have twice opened the abdomen in cases in which there existed the phenomena of obstruction of the colon, as shown by distension of the belly, vomiting, constipation, pain and the appearance of visible coils of intestine. In neither instance was any evidence of disease discovered within the abdomen, and in neither case did the symptoms return after the laparotomy. Allusion may also be made to those cases of chronic diarrhœa which are readily cured by chloral or bromide of potash.

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[1] *Journ. de Therap.*, 1877.

[2] Admirable articles on intestinal neuroses have been published by Stein (*Wiener med. Wochen.*, 1892, No. 20); Peyer (*Weiner Klinik.*, Jan., 1893) and André (*Gaz. Hebdom.*, 1892, p. 603).

It is usual in peritonitis for the mental faculties to remain perfectly clear up to the very verge of death. Among the 100 hospital cases already alluded to there were only eleven examples of intense headache or delirium. In all of these a fatal result ensued. An examination of the clinical details in these eleven cases does not reveal any common train of symptoms. They were for the most part acute cases, but by no means the most rapidly fatal, nor were they of necessity associated with high fever or severe symptoms, or the administration of unusual doses of opium. The ages of the eleven patients varied between 9 and 53 years.

A rigor does not often mark the commencement of peritonitis. Among the 100 cases this symptom was recorded in thirteen instances. In two of these the peritonitis had started in the appendix, in one it followed laparotomy, and in ten it had its origin in the pelvis. Of the thirteen patients ten died.

(2) *Meteorism.*—The degree of meteorism met with in peritonitis varies considerably, and is influenced by conditions which are not yet fully understood. When it exists its appearance is coincident with that relaxation of the abdominal muscles to which allusion has been already made.

Meteorism may be absent throughout the whole progress of the case, and examples of this are not uncommon in instances of septic intoxication attended with symptoms of a low type. It is most marked in peritonitis attended by actual intestinal obstruction, in examples of perforation, in cases in which there is thrombosis of the mesenteric vessels, and also in instances in which opium has been freely administered. It appears to present no definable relation to the amount or degree of the vomiting. In experiments in which artificial distension of the gut has been brought about, not only do all intestinal movements cease, but peristalsis cannot be induced by any of the usual irritants.

It has been often assumed that meteorism depends upon obstruction in the lumen of the bowel, and that it is due to an accumulation of gases in the intestine above the occluded point. These assumptions are not supported either by clinical experience or by experiments upon animals. It is true that the distended gut is entirely paralysed, and that it remains " paralytically fixed " in the abdomen ; but even when actual obstruction exists it cannot be shown that the meteorism is the greater the lower down in the tube the occlusion is placed. In some examples of peritonitis not a little of the swelling of the belly depends upon distension of the stomach.

The elaborate and varied experiments of Kader[1] and others make it evident that gas may be developed in an intestine emptied of its contents, and that meteorism, as met with in disease, depends almost entirely upon gross disturbances in the circulation of blood through the affected portions of intestine.

The series of experiments which bears most directly upon peritonitis is the following. The lumen of the gut is not occluded, but the circulation in a certain segment is controlled by a ligature applied at the root of the mesentery. The blood supply to the bowel is very greatly reduced, but is not entirely cut off. The whole of the intestine so treated becomes rapidly distended with gas, and a condition of wide-spread meteorism is produced. The animal exhibits the symptoms of severe pain, with vomiting and diarrhœa, and death results with varying rapidity.

Diffuse peritonitis favours the development of general meteorism in cases in which an artificial strangulation of the bowel has been produced.

It may be convenient here to mention that the following gases are normally found in the alimentary canal, viz., O, N, CO_2, CH_4, H_2S. The first three named are believed to be swallowed as air. CO_2 may originate in the stomach as a result of digestive disturbances. CH_4 and H_2S are normally met with only in the colon. The following are the results obtained by Bokai[1] by introducing these various gases into the intestinal canal of animals through a hollow needle. N has no effect. O causes the movements of the bowel to cease. CO_2 causes violent intestinal movements, and finally paralysis, if the action of the gas be prolonged. CH_4 and H_2S produce also vigorous movements of the bowel. Bokai believes that the purgative action of sulphur depends upon the liberation of H_2S in the intestine, and that the sedative action of bismuth depends upon its chemically fixing the H_2S existing in the bowel.

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[1] *Deutsch. Zeit. für Chir.*, 1891, p. 57. Other experiments are by Talma, Hessel, Karpetschenko and Schweninger.

It may be further added that fever artificially induced in rabbits by injecting decomposing matter under the skin causes a more or less complete paralysis of the intestine.

(3) *Vomiting.*—It has been many times remarked that there is no single distinctive sign

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[1] *Arch. für Exp. Path. u Pharm.*, 1887, bd. xxiii., p. 209.

of peritonitis. Could one single symptom be selected as the one more usually present in all cases of peritonitis it would probably be vomiting. In the 100 hospital cases vomiting is noted as very slight in as many as 23 per cent. of the examples. In some of these it is described as absent. This may be to some extent explained by the strict rules of dieting which are more rigorously insisted upon at the present day, and by the fact that a dresser or a nurse may not record the symptom unless the vomiting be copious or very distressing.

By very slight vomiting is implied vomiting in which the amount actually brought up is trifling. Compared with the sickness attending intestinal obstruction the vomiting in peritonitis generally may be spoken of as always slight. In a very large proportion of the cases which are carefully treated the patient will merely bring up a mouthful of fluid now and then. This is often accomplished with little effort, and many hours may elapse between the successive attacks. What is alarming and distressing in this slight degree of sickness are its persistence and the evil prognosis it suggests. The patient may be apparently improving, but there remains this periodical rejection of an ounce or so of fluid, which shows that the improvement is entirely delusive.

In some of the more insidious septic cases, and in such examples of peritonitis as occur in the aged or in the subjects of advanced visceral disease, the vomiting often amounts to little more than a slight irritability of the stomach.

In the instances in which the sickness is excessive, and in which the vomited matter becomes intestinal, there is something more than a mere reflex disturbance concerned.

Nothnagel,[1] Lüderitz, Bokai,[3] and others, have described the manner in which an anti-peristaltic action in the intestine may be induced by exceptional irritation, especially such as acts directly upon the bowel itself.

The normal emptying of the stomach through the pylorus has been well described as a function of the intestine.

In the cases of peritonitis following upon strangulated hernia the vomiting is for the most part very marked and often copious, but it bears no constant relation either to the state of the gut, the degree of peritonitis, or the height of the fever.

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[1] *Zeit. für Klin. Med.*, bd. iv., heft. iv., 1882.

[2] *Virch. Arch.*, bd. cxviii., 1889.

[3] *Arch. für Exp. Path. und Pharm.* 1887, bd. xxiii., p. 209.

In perforative peritonitis all symptoms are usually acute and pronounced. There is intense pain and a corresponding degree of collapse, and in the larger proportion of the cases vomiting is conspicuous. It is usually absent in examples of perforation of the stomach. In the cases connected with typhoid fever the relation between the vomiting and the action of the bowels is notable. If all action of the bowels cease, then the vomiting tends to be marked; but if the loose motions are continued, then the sickness is for the most part slight. In the most rapid forms of perforative peritonitis an actual inflammation of the serous membrane plays but little part. Death is from shock or acute general toxæmia.

In cases of peritonitis depending upon disease of the intestine, including mischief in the appendix, vomiting is not, as a rule, a pronounced symptom. In the cases of perityphlitis it is to be noted that it is least marked, as a rule, in the cases in which the bowels act with more or less regularity.

In peritonitis taking its origin from the pelvic viscera or parietes, vomiting is seldom very distressing. In the acute cases the symptoms are rather those of septicæmia, and in the chronic cases the disturbance has a great disposition to remain localised.

In peritonitis following upon operation or accidental wounds vomiting is rarely absent. It may not be marked, and may consist merely of an irritability of the stomach, but there it remains—a symptom which gives the greatest anxiety to the surgeon, and which no treatment appears capable of controlling. It may not be complained of by the patient, but as already said its gravity does not depend upon either its frequency or the amount ejected, but upon its deadly persistence.

(4) *Constipation.*—Cessation in the action of the bowels is a conspicuous feature in peritonitis. The morphia which is often so very freely administered in this affection probably takes some share in the production of this symptom.

In the 100 cases of peritonitis from the London Hospital the bowels are classed as "loose" in twenty-eight instances. In some of these twenty-eight cases there was actual diarrhœa, in others the bowels acted with frequency and without artificial aid, while in a third series of cases a free action was maintained by enemata or by aperients.

In two cases of peritonitis following hernia in which diarrhœa was met with, it is noteworthy that the peritonitis did not appear until after the diarrhœa had set in, a circumstance which suggests the action of the colon bacillus.

In eight cases of perforative peritonitis associated with a free action of the bowels at the time of the perforation (including four cases of typhoid) all passing of motions ceased in five examples when the lesion took place, while in the remaining three instances the bowels continued to act just as freely after the peritonitis began.

In these three cases the vomiting was much slighter, both in frequency and in amount.

In the twenty-two cases associated with disease of the appendix, there was constipation in nine cases (with four deaths), diarrhœa in four cases (with one death), while in the remaining nine examples the bowels acted naturally, or under the influence of enemata. In these nine cases there was only one death. It would appear therefore that—other things being equal—a better prognosis attends the cases in which the bowels are acting, and that a specially evil prognosis must be associated with the cases marked by absolute constipation.

(5) *Lung complications.*—In dealing with this feature of peritonitis, mere congestion of the lungs and a slight degree of bronchitis have been disregarded.

Among the 100 cases, there were no less than seventeen in which pleurisy or pneumonia appeared after the peritonitis set in.

In the examples of peritonitis of intestinal origin, there were seven cases, viz., two of right pneumonia, one of left, one of right pleurisy, one of left, and two of right pneumonia with double pleurisy. Five out of the seven cases were in instances of peritonitis associated with hernia or perforation.

In the examples of peritonitis starting from the pelvic organs, or from sources outside the abdomen, there were ten cases, viz., one of double pneumonia, two of right pleurisy, five of left pleurisy, and two of double pleurisy. In six of the instances the peritonitis had commenced in the pelvis—a notable fact—and in the remaining four, it was due to a wound of the abdominal wall.

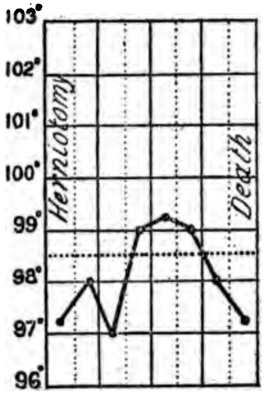

Chart No. 1.

Pneumonia after herniotomy has been supposed to be due to infective thrombi.

In two cases of pneumonia associated with gangrenous hernia, Fischer and Levy,[1] found the colon bacillus and the staphylococcus albus in the hernial sac, and also discovered the same micro-organisms in the pneumonic patches in the lungs. Both patients died with peritonitis, and in the effusion in the abdominal cavity the bacterium coli commune was found.

The nature of the peritoneal exudation appears to have little bearing upon the lung complications, because in the seventeen London hospital cases, the peritonitis is described as commencing in three, as plastic in three, as sero-purulent in five, and as purulent in six.

(6) *Fever.*—The temperature in peritonitis is liable to fluctuations so numerous and extreme that it is difficult, if not impossible, to deduce any type of temperature which may be considered to be characteristic of the disease. Probably there is no affection attended with fever in which the temperature charts of a large series of cases exhibit fewer data for the establishment of a common standard of fever.

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[1] *Deutsche Zeit. für Chir.*, bd. xxxii., p. 252.

A careful examination and analysis of the temperatures recorded in the 100 cases from the London Hospital makes it evident that the one symptom of fever can afford very little guide in estimating the gravity of the case or in forming a dogmatic prognosis. A comparison of the temperature charts in the cases that recover with those that die leads only to a bewildering result. In some of the fatal cases the temperature has moved steadily upwards, in others it has moved steadily downwards, in the third series of cases an even line of high fever has been followed, while in a fourth set of instances the temperature

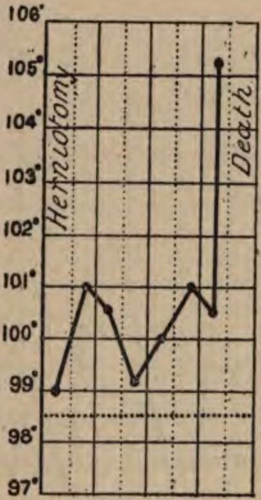

CHART No. 2.

has been about or below normal. It is quite evident that no marked or regular relation exists between the range of temperature and the character of the peritoneal effusion.

In very general terms it may be said that perforation leads at first to a sudden drop in temperature, and that if the body heat be at the time high the onset of diarrhœa is associated with a more or less rapid diminution of fever. Moreover, it may be remarked that the chart record which carries with it the stamp of an almost inevitably fatal result is that in which the temperature is for consecutive days below normal.

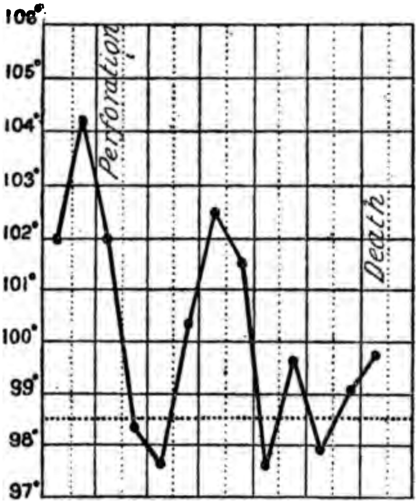

CHART No. 3.

The most robust evidences of fever are common in cases in which a plastic peritonitis, or one leading to well encapsuled pus, is present; while the examples associated with a low range of temperature often mark the cases in which a general sepsis (as from the intestine) is more pronounced than the peritoneal inflammation.

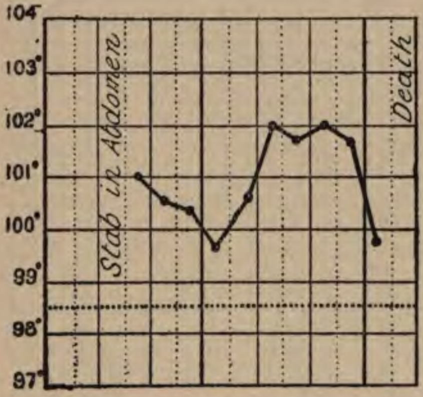

CHART No. 4.

The details of the temperature can best be illustrated by reference to the various forms of peritonitis.

In peritonitis due to hernia the temperature is for the most part low, and does not rise in the majority of the cases above 99.5. Chart No. 1 (from the case of a woman, aged 55, in whom a femoral hernia had been strangulated for three days before the operation) is fairly typical. In the autopsy the bowel was found to be slightly ulcerated. The other viscera were sound.

Before death the temperature in these—as in other marked septic cases—usually sinks lower and lower. Occasionally it may spring up to 105

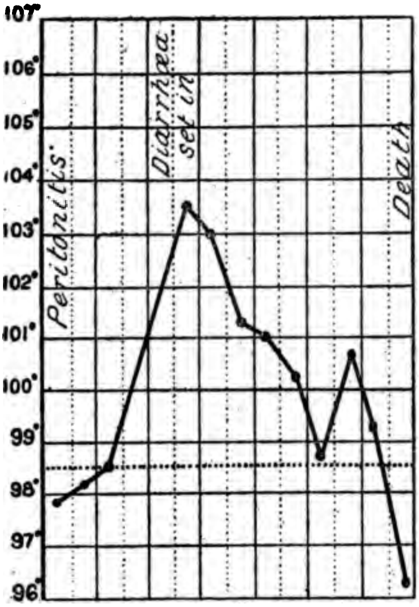

Chart No. 5.

just before death, as shown in Chart No. 2 (from a case of ventral hernia strangulated two days in a woman of 35. The gut was black but not perforated). This sudden elevation of temperature has been ascribed by some to a disturbance of the heat controlling centres by the circulation through them of blood charged with septic matter.

In the hernia cases the temperature ran highest (99 to 102 or 103), in those instances in which the gut reduced into the abdomen was practically gangrenous, or was extensively ulcerated. The onset of diarrhœa led to a fall in the temperature.

In peritonitis due to perforation, the temperature in the most rapid cases is that of collapse. If there be an existing high temperature at the time of the perforation, it may slowly sink, especially in cases in which the bowels continue to act freely, or may sink for a time and then rise again, as is commonly noticed in examples in which all action of the bowels ceases after the perforation. This is shown in Chart No. 3, from a lad of 19, with typhoid fever, and in whom perforation took place on the eighteenth day.

When the perforation is slowly brought about, the temperature may rise at first, and then sink slowly towards death.

Chart No. 4 shows the four-hour record of fever in the case of a lad of 18, who was stabbed in the abdomen, and in whom—after death—a small puncture in the ascending colon was discovered.

In peritonitis attended with gross disease of the intestine, the temperature is disposed to rise steadily, and then to drop somewhat abruptly before death. With actual gangrene of the bowel a high range of fever is common, and with profuse diarrhœa a lower range.

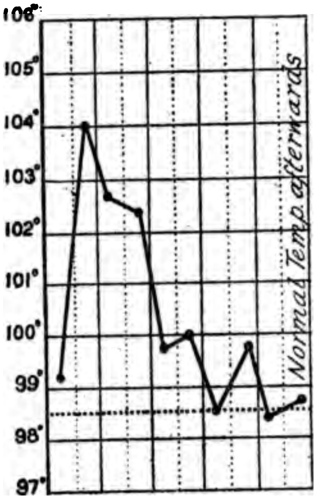

CHART No. 6.

Chart No. 5 belongs to the case of a woman, aged 49, with a growth in the descending colon, and ulceration of the bowel above it (there was no perforation). Peritonitis set in where the chart begins. On the third day a copious diarrhœa began, and its apparent effect upon the temperature shows a common condition.

In peritonitis due to mischief in the appendix, the fever is usually high and of the ordinary inflammatory type. Its average range is from 99 to 102 or 103. Its duration varies greatly, and a lower range of temperature is generally met with in the cases attended by diarrhœa.

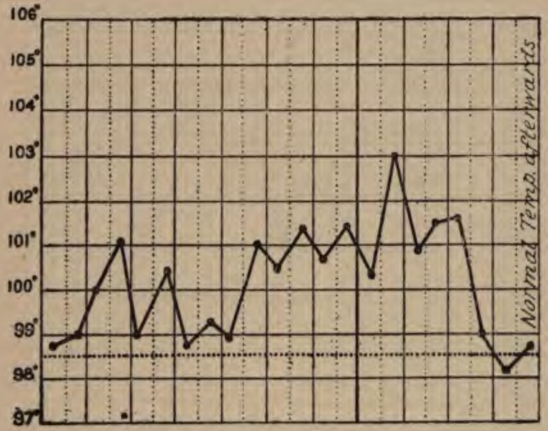

CHART No. 7.

Chart No. 6 is from a case of perityphilitis in a man aged 44, in which the earliest symptom was diarrhœa, and in which the bowels were kept open throughout by enemata.

Chart No. 7 is from a case of perityphlitis in a youth of 17, who was treated with opium, and in whom there was very marked constipation.

In peritonitis starting from the pelvis (with which is included puerperal peritonitis), the temperature is rather that of septicæmia. Chart No. 8 has been selected as fairly typical. It belongs to the case of a man, aged 53, who developed peritonitis on the seventh day, after a simple operation for fistula in ano. The trouble began

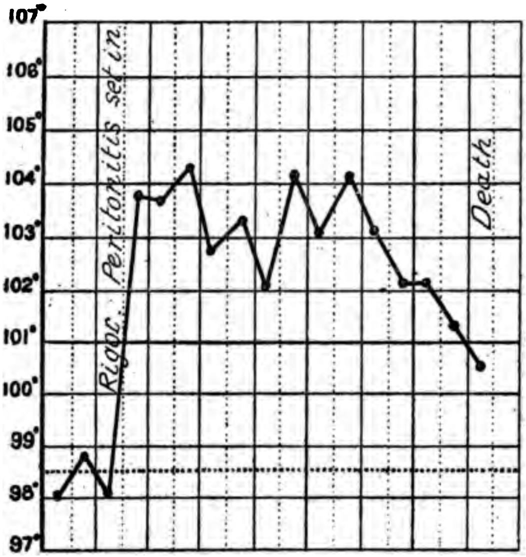

CHART NO. 8.

with a rigor. The autopsy revealed a general sero-purulent peritonitis with septic thrombosis of the pelvic veins.

In examples of peritonitis following wound of the abdomen, the temperature is for the most part fairly high, running on an average between 99 and 101 to 102. In two cases from the London Hospital series, it remained throughout below normal. Chart No. 9 is selected as an example of an uncomplicated case following laparotomy. The patient was a woman aged 26. The operation consisted in suturing a hydatid cyst to the abdominal wall. A general plastic peritonitis followed without any visceral complications.

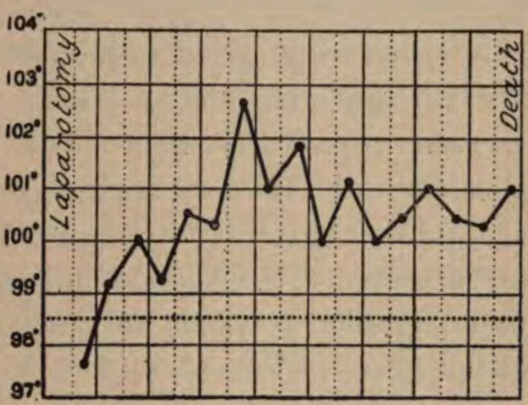

CHART No. 9.

THE TREATMENT OF PERITONITIS.—Before dealing in detail with this matter, a very brief reference may be made to the treatment as carried out in bye-gone years. Inasmuch as peritonitis, as an individual disease, was not recognised until the beginning of the present century, even the most elaborate review of the subject cannot extend very far back.

An excellent account of the treatment of the disease as practised in England eighty years ago, is to be found in a gossiping tract on "Peritonitis," by Thomas Sutton, M.D., late Physician to the Forces, and Consulting Physician to the Kent Dispensary.[1] His lines of treatment were as follows: first, absolute rest; second, purgatives; third, abstinence from food; fourth, cold to the abdomen; fifth, blood-letting in the acute cases; and sixth, opium to be given only occasionally and very sparingly. Dr. Sutton was not a believer in opium in peritonitis, except in the presence of intense pain. He made a great point of securing an action of the bowels when possible, and made frequent use of sulphate of magnesia.

Benjamin Travers, writing in 1812, advocated the same measures. He considered an evacuation of the bowels to be a matter of primary importance, but he appears to have relied largely upon enemata, and to have inclined towards warm fomentations.

The history of the surgical treatment of peritonitis is well given in the article on peritonitis in the "Dictionnaire Encyclopèdique des Sciences Medicales." Its modern developments are too well known to need detailing. Some credit in the past must be given to Jobert, who, in 1836, advised that in peritonitis with effusion, the abdominal wall should be incised, and water at blood heat injected. Guèrin, ten years later, recommended a copious washing out of the abdomen in generalised puerperal peritonitis. The peritoneal fluid was, however, to be drawn off with an aspirator, and warm water injected and withdrawn until it came back clear.

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[1] London, 1813.

In considering the treatment of any grave affection, it is well to recollect that certain of the so-called symptoms of a disease are not crass evidences of a disturbing evil within the body, but are rather the natural expression on the part of the organism of an attempt to rid itself of a trouble. Many symptoms are, in fact, curative acts, and are the measures of a natural treatment, and not the mere purposeless signs of an unnatural disturbance.

The cough and expectoration in bronchitis afford a means of ridding the lung of the products of a catarrh, set up in the bronchi by some irritant. The photophobia and lachrymation in ulcer of the cornea serve to keep the inflamed part moist, and to protect it from the irritation of exposure and of light. The vomiting in poisoning has for its purpose the evacuation of the substance which has caused the disturbance. In any one of these cases the treatment consists, not in an attempt to suppress these symptoms, but in an endeavour to encourage them.

In peritonitis the exhaustion, the rigidity of the belly wall, the pain, the vomiting, and the not infrequent sense that the bowel needs to be emptied of flatus, would suggest the recommendation of attempts to relieve absolute rest, of pain, of starvation, and, under certain circumstances, of means to relieve the intestine. If, in contemplating a patient with peritonitis, one could regard his more conspicuous symptoms as natural attempts to afford relief, they would appear to be in the direction of securing quiet within the enclosure of the abdomen, and of effecting an evacuation of the alimentary canal.

In the account which follows of the treatment of peritonitis, this suggestion from the therapeutics of nature is not disregarded.

(1) *Rest.*—Absolute rest in the recumbent position appears to be the first obvious indication. The knees may be flexed over a pillow to lessen the tension on the abdominal walls, and to favour the patient's instinct to assume that posture. The upper part of the chest and the ever restless upper limbs should be protected by a woollen

jacket, and no reasonable restraint offered to the patient's inclination to hold the hands above the head. This favourite posture, by acting upon the lower part of the thoracic wall, assists also in diminishing the tension within the abdomen. It is cruel to insist that the hands should be kept beneath the bedclothes. The state of misery in peritonitis is acute enough without being increased by purposeless and rigid formulæ. Cold hands do not cause death, but as on exposure they tend to become cold they should be covered up. The wretchedness of restlessness has a natural relief in little movements.

(2) *Feeding.*—The old rule of eighty years ago of giving as little food as possible by the mouth cannot be improved upon. The stomach is not in a condition to receive nourishment, and what is taken usually remains unutilised, and is returned unchanged. The practice sometimes met with of laboriously plying the patient with teaspoonfuls of this meat extract or of that, recalls the legend of the Danaïdes, who spent their energies in pouring water into pitchers without bottoms.

In the matter of feeding there are two extremes to be avoided. The first is the rigid, unreasoning, and often needlessly cruel prohibition of food of any kind by the mouth, and the second is the reckless and intemperate use of ice, or iced fluids.

Thirst is often a most terrible symptom in peritonitis. It is not always quite relieved—at first, at least—by rectal injections. The patient is ready to give his life for a drop of cold water. If he takes it he is sick, but he is much relieved. This little indulgence does not introduce anew the symptom of vomiting. It is there, but it is latent, and the drop of cold water only makes it evident. The patient will not die of vomiting and simply because a rigid exclusion of all fluid by the mouth does not render the symptom apparent it does not render it non-existing. The man would sooner vomit than endure his thirst. Very often great relief is given by allowing a fairly copious draught of fluid, which is soon rejected, and which—as it were, by washing out the stomach — leaves the patient for a while infinitely comforted. On the other hand, the perpetual sucking of ice is as bad as the perpetual teaspoonful of useless jelly or of decomposible meat juice. The filling of the stomach with iced water does undoubtedly add to the general depression of the patient, especially when vomiting has been brought into abeyance by morphia.

The right course appears to lie between these two extremes. There should be no rigid formula except this—let the patient take as little food as possible by the mouth. If there be a raging thirst, let him have a little ice—and very little suffices—or a little iced milk and soda water, or if, as is common, the inclination lies towards something warm, let him take a few spoonfuls of hot water or of weak tea made hot, or of beef tea at a like temperature. It is not the nourishment that is needed (and I imagine that the nourishment in beef tea is merely an ancient but cherished fiction), but some fluid in the stomach.

It is better within reasonable limits to be guided by the patient's own instincts than by a blind formula founded upon a doubtful physiology. This same physiology has added very much to the miseries of death from peritonitis.

As regards actual feeding—in the usual sense—that should be carried out by rectal injections. The injections should be small in amount, should be weak, should be made of some peptonised meat extract or infusion, should be given slowly, and should be of the temperature of the body.

An injection of two to two and a-half ounces of peptonised beef tea with half an ounce of brandy appears to answer well, and may be given every three or four hours. Thirst is better relieved by an injection of half a pint of warm water given alone, than by diluting the nutrient enema to that extent.

I do not think that nutrient suppositories are so well suited for cases of peritonitis as is the ready-made fluid injection. Irritability of the rectum may be to some extent met by washing it out now and then, and by a weak injection of cocaine. In the more advanced cases, the sphincter begins to relax as the loss of power progresses, and then very usually nothing can be retained. It is undesirable to harass the last hours of a dying man by nutrient enemata, simply because it is the custom.

If there be diarrhœa, or if the bowels be acting freely, then rectal feeding cannot be adopted, but fortunately in these cases, the vomiting is slight as a rule, and fluid and a certain amount of nourishment can be taken by the mouth.

It is, perhaps, needless to add that in cases—with or without diarrhœa—in which there is no vomiting, all that is given may be given by the mouth.

Much complaint is often made by patients with peritonitis, of the horrible state of the mouth. The tongue is dry and stiff, and such sense of taste as remains, is only capable of appreciating a bitter nastiness. Something can be done to relieve this by keeping the teeth brushed, by washing the mouth out with a 1 in 80 carbolic lotion, or with a mixture of Eau de Cologne and water, by actually cleaning the tongue and by keeping it moist with glycerine and water.

(3) *Opium.*—Here again, the old practice appears to be the best. Give as little opium as is possible. In the early stages of acute peritonitis, and especially in the perforative forms, and in those depending upon appendix troubles, morphia in the form of a hypodermic is absolutely necessary. In the worst instances, it may certainly avert death from shock. Under its influence the patient revives, and the more intense symptoms become greatly modified.

Morphia should never become a feature in the routine care of peritonitis. It masks the symptoms, hinders the natural process of cure and hampers treatment.

The indication for it is actual pain, and not mere restlessness and misery. In the really septic forms, but very little morphia is called for, and often none at all. Its evil effect in the after treatment of cases of abdominal section has been amply demonstrated.

In quite hopeless cases, there can be no objection to its freer employment, but in other instances the administration and the dose of the drug must be sanctioned and measured by the one symptom, pain.

I have noticed that in those who are dying of general peritoneal sepsis, a greater sense of relief usually follows the hypodermic injection of strychnia than attends the use of morphia. The strychnia appears to act as a stimulant would—the patient revives for a while and feels more hopeful under its influence, his moanings cease, his miseries are less unendurable, and for the twentieth time he thinks he may get better.

(4) *Aperients.*—At the commencement of the century the use of aperients was a necessary element in the routine treatment of peritonitis. By aperient treatment may be understood the obtaining of an action of the bowels by either drugs or enemata. After a certain number of years the practice altered, and the dictum went forth that when any signs of peritonitis were present, aperients were to be absolutely forbidden.

Within the last few years the more ancient method has been revived, but it has been revived with very radical modifications. To Mr. Lawson Tait the profession is indebted for this return to an almost forgotten practice, and above all, for the employment of that practice with the new element of discrimination. Mr. Tait's measure has been frequently spoken of as "the treatment of peritonitis by aperients," and it has been assumed by some—and probably with disaster—that a purgative is necessary in every case of peritoneal inflammation. Mr. Tait's precise words on this subject are as follows:—"I have never said that the purgative treatment will cure peritonitis, for peritonitis, once it is completely established, is a practically incurable disease, and almost uniformly fatal."[1]

It is on this very point that the centre of the position with regard to this treatment turns.

Aperients can never be adopted in the routine treatment of peritonitis. In the larger proportion of cases this measure is entirely useless, and in the great series of the septic forms it is more or less impracticable.

In most of these septic examples enemata of any kind may be administered, and purges of any character may be given, and the probability is that the bowels will not act at all, and if they do respond it is more than probable that the treatment will not affect the prognosis in the least, and certainly not in the patient's favour. If the aperient could eliminate the fatal poison which is circulating in the patient's system, then good may follow, but even the most enthusiastic advocates of purging cannot credit their drugs with this power.

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[1] *British Medical Journal*, Nov 12, 1892, p. 1050.

There is no doubt but that there is within the intestine an amount of noxious or poisonous matter which remains harmless so long as the viscus retains its normal condition, but which may lead to septic symptoms if certain changes are induced in the wall of the bowel or possibly in its contents. This has been especially shown in connection with the potentialities of the colon bacillus, and it is clear that these noxious elements include, not only simple chemical substances, but also various micro-organisms and their hurtful products.

Equally evident does it appear to be that the injurious matters within the disordered bowel can, within certain possibly narrow limits, be got rid of by the action of aperients. In acute intestinal strangulation death may follow in a few days. The patient in such case dies neither of pain, nor of vomiting, nor of the obstruction to his bowels. After his death there may be found no signs of peritonitis, or evidences only of the slightest form of that condition. He dies of general septic intoxication, and the poison is derived from his intestine.

This poison is rendered potent by the abrupt and gross changes which the strangulation has produced in the intestine. Mere retention of the contents does not explain the disastrous results. In examples of chronic obstruction the bowels may not act for six or eight weeks, and yet the patient may recover. The subject of a constipation of this degree will, it is true, exhibit some signs of poisoning. He is languid and apathetic, he vomits, the taste in his mouth disgusts him, he has headaches, his breath is rendered intensely offensive by reason of the matter, probably gaseous, which has been absorbed from his intestine, and is to some extent discharged from the blood through the lungs.

Some gross disturbance in the complex mechanism of the bowel wall is needed to render the poisonous contents of the intensive acutely poisonous and to favour its ready introduction into the system. Of the effect of a thorough evacuation of the alimentary canal in such an instance surgical experience can testify.

Such a case as the following must have come within the knowledge of every surgeon who has dealt with many cases of intestinal obstruction.

Some years ago I was called to see a vigorous man of 45 who had suffered from acute intestinal obstruction for some three days. I opened the distended abdomen, and I recognised that peculiar faintly stinking peritoneum with which such operations soon make one familiar. Immediately beneath the incision was revealed a single omental band which had caused the trouble. This was divided, and the abdomen was closed. The operation lasted a few minutes. Still the man died, and the autopsy revealed no perforation and no gangrene of the bowel, and no abnormal change in the peritoneum save a little stickiness. The patient died, not because his bowels were obstructed, but because that obstruction allowed septic matter to be absorbed from his intestine. His trouble was not outside his bowel but within it. Had I made an opening in the gut and allowed the poison-loaded viscus to relieve itself, the result may have been different. Such an operation would have been comparable to the washing out of the stomach after an active poison had been swallowed.

It is a fact that the most successful treatment of acute obstruction of a certain grade is that which provides for a thorough evacuation of the loaded gut. A blindly executed enterostomy, with an utter ignoring of the cause of the obstruction, has been attended by better results than have operations in which the agent of the obstruction has been discovered, after elaborate search, and has been satisfactorily dealt with. This treatment of acute obstruction by the evacuation of the bowel before all things, we owe to Benjamin Travers, the father of Intestinal Surgery. In cases of strangulation of a certain degree he insisted that the bowel should be cut into and emptied, even after the obstructing band had been removed. He considered that the operation was not complete until this had been done; he urged that safety was only to be obtained by an evacuation of the gut, and he supported his views by numerous cases and experiments.

Another illustration of these selfsame points is afforded by perityphlitis. In a previous section of these lectures I have shown that those cases of perityphlitis, in which there is diarrhœa, or in which the bowels act naturally or under the influence of aperients, are attended with a much lower mortality than are the cases in which constipation is marked. In my own experience I am convinced of the value of the aperient treatment in the earliest stages of these cases, and of the pursuit of the same measure throughout in selected instances. In some cases, however, nothing within reason will bring about an action of the bowels. The subjects of repeated attacks of perityphlitis are aware themselves of the evil effects of constipation, and many of them have learnt that they can ward off an attack or minimise it, when it comes, by a prompt aperient.

A further illustration of the subject from the same standpoint is afforded by that alarming intestinal condition which is sometimes met with after abdominal operations, and which was at one time spoken of as peritonitis. The exact nature of this condition was, I believe, first recognised by Dr. Malcolm.[1] It has been fully dealt with subsequently by Olshausen[2] and Verchère.[3] The former writer has applied to it the convenient name of "pseudo-ileus." The symptoms are these. On the second or third day after a not necessarily severe abdominal operation the abdomen becomes distended, the patient becomes uncomfortable, and complains of "wind." The distension increases; vomiting sets in. At first only the contents of the stomach are rejected; very soon the matter becomes bilious, and finally there is copious "coffee-grounds" vomiting, and this may present a feculent odour. The vomiting tends to become worse and worse, and is much more copious than is common in peritonitis. The pulse becomes smaller and feebler, the temperature usually sinks, and exhaustion increases with alarming rapidity. On the fourth or fifth day after the operation the patient may die. At the autopsy the peritoneum may be found to be practically unchanged, or to exhibit so trifling a degree of peritonitis as not to account for the symptoms, nor for the fatal result. Various explanations of this condition have been given. There is no doubt that the nervous disturbance which attends any abdominal operation leads to some degree of intestinal paralysis. This paralysis, attended as it is by vasomotor changes in the bowel wall, is favourable to the absorption of septic matters from the intestine. The paresis may be slight and may disappear spontaneously, or it may subside if the distension of the bowel can be relieved by the introduction of a rectal tube. If it persist it appears to permit of a filtration through the intestinal walls of septic materials, of bacteria or of their products. These latter are readily taken up by the peritoneum and a septicæmia commences. This is the explanation given by Olshausen, Verchère and others, but it is not accepted by Dr. Malcolm.

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[1] *Med. Chir. Trans.*, vol. lxxi., 1888, p. 43.

[2] *Central. für Gynæc.*, Jan., 1888.

[3] *Revue de Chir.*, July, 1888.

Anyhow, it was pointed out by Mr. Tait and has been made evident to most surgeons who have followed his teaching, that if an action of the bowels can be obtained at the outset of the symptoms, either by the administration of a purgative or by an enema, the trouble in a large proportion of cases passes away and the patient makes a good recovery. It cannot be said that this good result follows in all cases, and it is evident that the purgative, like the emetic given in acute poisoning, can only bring about an arrest of the symptoms within certain limits.

It only remains to point out that when once general peritonitis has established itself, an aperient is without avail. In those septic cases in which diarrhœa occasionally sets in, this is only too apparent.

An example such as the following serves to illustrate this point :—

A woman, aged 43, was seized with symptoms of acute abdominal trouble some hours after eating a very heavy meal. She was admitted into the London Hospital on the fourth day after the onset of the attack. She had then the symptoms of peritonitis. A laparotomy was performed, and an enterostomy was carried out without any attempt having been made to discover the cause of the inflammation. The patient died in two days, and before that time the bowel had entirely emptied itself through the artificial opening. The symptoms of peritonitis were in no way influenced, and I imagine that the patient's death was neither hastened nor delayed. The jejunum was found to be gangrenous in two places, as a result of very acute enteritis. There was general peritonitis but no perforation.

In conclusion, therefore, it must be said that aperients—in the ordinary sense—are of no avail in established general peritonitis. That in the peritonitis following hernia, or associated with acute intestinal obstruction, the complete evacuation of the bowel is desirable, for reasons which are apart from the peritonitis.

In septic peritonitis—in the usual acceptation of that term—aperients are useless, and the same may be said of their employment in true perforative peritonitis.

In a large proportion of examples of perityphlitis, and in the pseudo-ileus which may follow after operation, the prompt evacuation of the bowels is often attended with the very best results.

On both theoretical and clinical grounds, the thorough emptying of the intestine before any abdominal section is performed, may be regarded as absolutely essential.

(5) *Blood-letting.*—This measure of treatment may with advantage be more extensively employed. It is no longer likely to be used in the unreasoning and mechanical fashion of by-gone days. In robust forms of localised peritonitis, blood-letting is attended with admirable results. In perityphlitis the application of half-a-dozen leeches often acts with magical effect.

In the older accounts of the treatment of peritonitis by bleeding, no good appears to have followed in cases in which the inflammation was diffused, except, perhaps, in some examples due to injury. On theoretical grounds this is precisely what would be expected.

(6) *Operative measures.*[1]—These are represented by incision and drainage, with or without irrigation. This treatment must be considered as it applies to peritonitis, under two entirely different aspects. In one series of cases there is vigorous well-defined inflammation, the local symptoms are marked, pus is produced, and may be considerable in amount, and the exudation is more or less clearly localised. Examples under this heading are afforded by peritonitis started by mischief in the vermiform appendix, by many

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[1] The treatment of tuberculous peritonitis is not considered. See Lecture IV.

forms of peritonitis within the pelvis, and in the sub-phrenic region, and by certain cases of limited inflammation following upon injury or perforation.

In the other series of cases, the peritonitis is diffused, the constitutional symptoms are more prominent than the local ones, the changes in the serous membrane—so far as evidence of inflammation is concerned—are comparatively slight, and are out of proportion to the general disturbance. This form is illustrated by cases in which there is a general septic intoxication starting from the peritoneum, by peritonitis due to perforation, or following after strangulated hernia or enteritis, by puerperal peritonitis, and by examples of genuine peritonitis following operations upon the abdomen.

In the first series of cases surgical interference by incision and drainage ranks with the procedure of evacuating a large abscess.

In the second series the cut into the abdomen and the subsequent flushing out or drainage, are to be compared with the washing out of the stomach after an active poison has been swallowed.

In the one case the body has to be rid of the products of a robust and possibly limited inflammation; in the other case an attempt has to be made to remove from a cavity a poison which has already wrought no little harm. The operation in the latter instance is directed not so much against an inflammatory outbreak as against a progressive poisoning.

The operative treatment of suppurative peritonitis, especially when the effusion is localised, has been remarkably successful. Records of the operation extend back into the eighteenth century, and all that modern surgery can lay claim to is the application of the treatment with greater boldness, with greater frequency and with infinitely less delay.

The operative treatment of general diffused non-tuberculous peritonitis has, so far, no record to boast of, and little progress to chronicle. I am doubtful if a single human life has been saved by surgical interference in a genuine case of peritoneal toxæmia. Surgical treatment has been most discouraging in acute peritonitis following upon gangrenous hernia, upon operation, and upon puerperal infection. It has met with but little better results in cases of perforation, in which the serous inflammation has been well established.

The somewhat imposing lists of cases of success after laparotomy for acute suppurative peritonitis, afford sorry matter for congratulation, when submitted to a careful scrutiny.

The following may be cited as illustrative of this:—Krecke[1] gives a list of 119 cases of generalised purulent peritonitis treated by operation, and attended with only 68 deaths. In 18 instances the cause of the peritonitis was unknown, and in 36 cases it was due to trouble in the appendix, and it is among these 54 examples that the greater number of the successes are to be found. All the cases of peritonitis associated with hernia or with perforation of the stomach, died.

Steinthal[2] gives a list of 20 cases of perforative peritonitis treated by operation. There were 10 recoveries, but in no less than 7 of these cases the pus was encapsuled, and was apparently dependent upon perityphlitis. At least it is stated that in 11 cases out of the 20, the perforation was in the appendix. Some of the cases are remarkable enough, but they are not examples of that form of generalised peritonitis which is usually associated with perforation.

Kaiser[3] has collected thirty cases of operation in perforative peritonitis, with eleven recoveries. In five of the examples of cure the locality of the perforation was unknown.

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[1] *Munch. med. Woch.*, Aug., 1891.

[2] German Surgical Congress, 1888.

[3] *Deutsch. Arch. für klin. Med.*, 1876, bd. xvii. See also Siewe, *Archiv. gen. de Méd.*, 1893, t. i. and ii. Krönlein, *Langenbeck's Archiv.*, bd. 33, p. 507. *Congrés Franc. de Chir.*, 1889, p. 197, and Mickulicz, *Deutsch. Ges. für Chir.*, 1889, p. 303.

Körti[1] after pointing out the fallacy of statistics and the fact that the successful cases are probably all reported, while the failures are commonly left in obscurity, gives a list of forty consecutive cases operated upon by Mickulicz, Krönlein, and himself for purulent peritonitis. Out of this number there are eleven recoveries, and these include no less than seven cases of perityphlitis.

Kriege[2] gives a case of perforation of the stomach, which was treated successfully by an operation carried out twenty-four hours after the viscus was supposed to have given way, but in this instance there was no peritonitis. He incidentally alludes to six other recorded cases, all of which ended in death.

Some very excellent results have attended early operation for injury of the bowel and other abdominal viscera, but these results cannot justly be considered in connection with laparotomy for fully established peritonitis.

As to the actual mode of operating adapted for the different varieties of peritonitis, I would venture to draw attention to the following points. In all cases it is to be assumed that the skin over the operation area is cleansed and prepared in a suitable way, and that the surgeon adopts those measures which students, in their examination papers, are so fond of describing as "strict antiseptic precautions."

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[1] *Deutsch. Ges. für Chir.*, 1892, p. 131, 160.

[2] *Berlin. klin. Wochen.*, 1892, p. 124.

In cases of localised purulent peritonitis an incision should be made into the collection by the most direct route. When the pus has escaped a rubber drainage tube of suitable size and with stiff fenestrated walls should be passed to the bottom of the cavity. A dressing of some absorbent material, such as Tillmann's paper, sal alembroth or cyanide gauze is then applied. I have seen no advantage attend eitherthe fuller evacuation of the pus by squeezing, or the immediate irrigation of the cavity, and I am confident that distinct harm may be done by scraping the wall of the enclosure, by persistent searching for a diseased appendix or other cause of the trouble, and by stuffing the exposed space with a considerable quantity of gauze.

At the end of twenty-four or thirty-six hours the irrigation of the cavity may be commenced and continued twice daily, and now and then a little iodoform emulsion may be introduced.

In some examples of perityphlitis a well encapsuled collection of pus is not exposed, but the knife enters into an ill-defined district containing a variable quantity of thin, greenish, and often offensive matter, which appears to saturate the tissues. In such circumstances I have been in the habit of using a drain composed of strips of iodoform gauze, which are carefully introduced into the lowest accessible recesses of the region.

In cases of generalised peritonitis the procedure adopted must obviously depend upon the cause and degree of the trouble. If the exudation be serous it will suffice if the fluid be evacuated, if the peritoneal cavity be gently dried in its most dependent parts by means of gauze sponges, and if the abdomen be closed without drainage.

When the exudation is sero-purulent or purulent it is in many cases desirable that the cavity be irrigated. The fluid which appears to be best suited for this purpose is a sterile .6 per cent. salt solution made warm. The details of irrigation will be discussed later on. After the washing the depths of the peritoneal cavity are dried, so far as is possible, with sponges, iodoform powder (except in children) is dusted over the portion of the serous membrane most involved, a long, rubber, fenestrated drainage tube may then be introduced and the abdominal wound be closed. Any treatment directed against the cause of the peritonitis will be independent of these measures. In the treatment of the ascitic forms of tuberculous peritonitis the best results have followed simple incision without either irrigation or drainage. The use of the rubber tube is apt to be followed by an obstinate sinus. (See Lecture IV.)

There are cases in which the peritonitis is more plastic in character. The intestines are found to be matted together with greyish lymph, which may be present in considerable quantity. The breaking down of these adhesions causes no little amount of bleeding, and such a step is evidently destructive of a certain desirable process of repair. Still, in order to search for the cause of the peritonitis, assuming such search to be indicated, and to set free an amount of exudation which is imprisoned between the attached coils, this freeing of adhesions must be to a certain, very limited extent carried out. There will probably be a sero-purulent exudation in the belly cavity, and the gentlest movements of the fingers among the recently attached intestines will set free more fluid, which will be probably less opaque. A clump of adherent intestines will often cover and protect a perforation, and the ubiquitous lymph will many times close such an opening with more speed and security than are provided by any system of suturing.

As the surgeon therefore reaches what appears to be the starting point of the peritonitis, he must proceed with the utmost caution, and be not only prepared, but rather inclined to leave the actual *Fons et origo mali* undemonstrated. The main purpose of the operation is to allow a noxious exudation to escape, and if possible, to free the peritoneum of the cause of its trouble. In the class of case now under discussion, a perforation will be very often the starting point of the peritonitis ; the lapse of time and the plastic character of the inflammation afford evidence that the perforation is, for the time being, closed. If the operator can rid the serous cavity of the effects of the perforation, he may very often leave the breach itself to be dealt with by natural means.

The wisdom of doing no more than is necessary, or as little as is obvious, is well illustrated by these cases. It is a very striking fact that some of the best results in the treatment of perforative peritonitis have been obtained in instances in which the exact site of the perforation was never ascertained. In Kaiser's statistics already alluded to, there were six such examples, and of these five recovered.

In this form of peritonitis a liberal dusting of the serous membrane with iodoform should be carried out (except in cases in children). Drainage is seldom required, and when employed is best provided for by strips of iodoform gauze passed among the intestinal coils to the necessary depth.

Irrigation is certainly not suited to this class of case. Gauze mops or sponges in holders form the best means of clearing the peritoneum under the circumstances named.

It only remains to consider what means may be taken during the performance of an abdominal section to prevent the onset of peritonitis, and to discuss the two vexed questions of irrigation and drainage.

"The modern Laparotomy," as Dodulein[1] presumes to call it in a recent elaborate paper, is a procedure which has evidently not yet reached the stage of recognised formulæ, nor attained to the position of a stereotyped process.

A perusal of the numerous writings upon the technique of the operation leaves an impression that the opening of the abdomen is still regarded with an almost superstitious awe, and is still approached by many with a fussy and meaningless ceremonial, that elaboration of detail may be carried to a degree which is merely fatuous, but that although surgeons differ greatly in their methods, they differ but little in their results.

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[1] *Deutsch. med. Wochen.*, May 25, 1893.

It is impossible to avoid the temptation of pointing out that an infinitely elaborate technique is no substitute for lack of skill in operating, and that the power of the human body to resist the effects of injury is not capable of unlimited extension by artificial means.

It is needful in the first place that the operation room should be surgically clean, that the patient should be clean, and that the operator should be clean. The attaining of this end appears to be as satisfactorily accomplished by the charwoman, the laundress, and the nail brush, as by complex chemical processes.

There seems to be no imperative need that the operation chamber should be capable of being washed out in the same manner as the interior of a cup, nor do results show that it should be so constructed as to be convertible into a vacuum or so ventilated as to admit only a stream of sterilised air.

The skin over the abdomen can be prepared by a liberal scrubbing with soap and water, followed by washing with ether and the final application of a carbolic compress, which is applied some hours before the time fixed for the laparotomy.

Ligatures and catgut are, I think, best kept in an ethereal solution of corrosive sublimate. They can be dipped into sterilised water just before they are used.

The methods of rendering instruments surgically clean are legion. I adopt the practice of placing them in a 1 in 20 carbolic solution for fifteen minutes previous to the operation. Just before they are used the solution is diluted with sterilised water until it represents 1 in 80 or 1 in 100 in strength. To take an instrument direct from a strong carbolic solution and use it within the abdomen, is to bring a caustic and damaging irritant into contact with the peritoneum, inasmuch as some of the solution must drop from the knife or forceps so employed.

Gauze sponges do fairly well for the peritoneum if properly prepared. They are best left to soak for some time in a 1 in 20 carbolic solution, which is very freely diluted with boiled water just before the sponges are passed through the roller.

Ordinary sponges in holders are better adapted for the depths of the cavity. As they are not readily cleaned after use they are burnt as soon as they have been once employed. This disposes of many uncertainties.

It is obvious that the less the peritoneum is touched, stretched, rubbed and handled, the better. Now and then it may be desirable to repair, with a continuous suture, any rent made in its surface.

I have tried every method of closing an abdominal wound of which I have had any knowledge. I believe the best plan is to steady and straighten the wound edges with blunt hooks while the needle is being passed; to sew up the peritoneum with a continuous suture of fine silk, and to close the rest of the parietal wound with a single row of silkworm gut sutures which embrace all the soft parts, excepting the serous membrane, and which are passed by means of straight needles.

Any damaged surface of peritoneum should be well dusted with iodoform, and into the ragged cavity left after the removal of an adherent kidney or a sessile tumour, a liberal quantity of the same powder may be introduced. I have reported certain cases which encourage the impression that some security against peritonitis is to be obtained by the free use of iodoform within the abdominal cavity.[1] Iodoform should not, however, be used in the case of children, as it is very apt to produce in them symptoms of poisoning.

It is needless to say that the peritoneal sac should be left as dry and as clean as possible; that all bleeding should be carefully arrested, and all clots, pus, cyst fluid, and the like, should be thoroughly removed. It is possible, however, that these ends may be attained at too great a cost, and that the "toilet of the peritoneum" may become a very uncouth and barbaric process. Within certain limits I believe it is often less injurious to leave some blood clot in the abdominal cavity than to persist in an obstinate determination to remove it at any sacrifice.

An ounce or so of cyst fluid in the peritoneal sac would I think do less harm than an attempt to complete the toilet of the peritoneum as carried out by a mechanically conscientious man. This toilet is often a Brobdingnagian affair, and when strong antiseptics and countless sponges are employed it degenerates into mere violence, and is rather of the nature of an assault. If the infinitely tender character of the peritoneum be held in mind, this toilet—as sometimes practised—is comparable to the removing of a foreign body from the eye by means of a scrubbing brush and plenty of washing soda.

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[1] *The Lancet*, June 10, 1893.

This now leads us to the subject of irrigation.

Irrigation. — Mere blood is better removed from the peritoneal cavity by sponging, than by irrigation.

If the operation area be well circumscribed by sponges, if the shoulders be raised so that blood will reach the more dependent tracts, and if a sponge be introduced into the pelvis at an early stage of the procedure, there is little trouble with blood clot. Coagulated blood is certainly very much more easily and certainly removed by means of gauze sponges, than by a stream of water. The same observations apply to what may be termed healthy cyst contents, to fluid from hydatids, to bile, and to matter escaping from the stomach or intestine. With careful plugging and a watchful use of sponges a widespread extravasation is uncommon.

If it does take place the gauze can usually reach it.

Irrigation would possibly have the effect of spreading the noxious fluid—as for example intestinal matters—over a still wider area.

It may be said, therefore, that if certain precautions be taken, the cleansing of the peritoneal sac may be best and most safely accomplished by dry sponging.

If there be a considerable outpouring of such a material as putrid pus, or if there be a copious escape of gut contents, as from the giving way of a distended bowel above a point of obstruction, then it may be better that the whole peritoneal cavity be irrigated. In such a case the amount of the extravasated fluid and its wide distribution would render its complete removal by sponging difficult.

This irrigation is best conducted by the following means. The fluid used is a sterile .6 per cent. salt solution at blood heat. It is introduced at low pressure but in a wide stream. The irrigating tube is of soft rubber and may have a diameter of three-quarters of an inch. The tube itself is introduced into the belly cavity. The flow through it can be regulated by a clip. Any form of rigid nozzle is to be most strongly condemned. The solution should flow gently into the abdomen. The peritoneal cavity is to be flooded and not to be scoured out with a violent stream of water, which hisses and rushes from a vulcanite nozzle as from a miniature fire-hose.

When the belly cavity is quite full of fluid the surgeon's hand—which is already in position—is moved to and fro among the intestines with great gentleness. The coils of bowel are thus rinsed. By a movement of the hand and by pressure here and there the fluid overflows from the wound and is replaced by the steady stream.

As the water which escapes becomes clear the upper end of the operation table is raised, so that the shoulders are much elevated, and then little has to be done but to wash out the most dependent parts, including especially the pelvis, and to allow the upper parts to drain. Finally, what fluid remains in the pelvis is removed with sponges, and a sponge in a holder is retained in the bottom of the pelvis during the introduction of the stitches, and only withdrawn at the last moment.

In the actual process of irrigation it is important that the temperature of the fluid be constant, that the abdomen be never over distended, and that the stream be not directed against the diaphragm. If these precautions be neglected alarming dyspnœa and even asphyxia may take place.[1] If the shoulders be well raised—as already advised—these respiratory complications are less likely to occur. Polaillon has observed three cases of cessation of respiration in the human subject during irrigation.

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[1] Delbet, *Annales de Gynec.*, Sept., 1889. Reichel, *Deutsch. Zeit. für Chir.*, bd. xxx. p. i. Kinscherf, " Inaug. Dissert.," Heidelberg, 1892.

Many surgeons have written of late on the subject of irrigation, and the general bias of these communications is very strongly against irrigation. Fluids of all kinds have been used, such as solutions of carbolic acid, of corrosive sublimate, of boric acid, and of salicylic acid. The two last named are the most in favour. Many operators employ boiled water, and not a few a weak preparation of alcohol.

It is evident that whatever fluid is employed, it cannot be used as a germicide, and that all that can be aimed at is a solution which is sterile and non-irritating.

It has been urged that irrigation serves to spread the infective material, which it is required to remove, over a wider area, and that it seriously diminishes the resisting power of the peritoneum. Reichel[1] strongly insists upon the latter objection. He found that in artificially produced peritonitis in dogs he was never able to ward off death in any case in which it was to be assumed that the animal if left alone would die. He introduced fæcal matter into a dog's peritoneum, and, having closed the wound, he re-opened it after a while and employed irrigation in some cases and sponging in others. He found neither method entirely successful in cleansing the serous cavity, but was convinced that sponging was the more efficient of the two. Even when from 10 to 15 litres of fluid was used a quantity of infective matter was still found to have been left behind. He irrigated the healthy peritoneum in certain animals with boiled water. All the animals so treated recovered, but some were ill for a long time, and some had urgent dyspnœa. These simple irrigations produced a blood-stained exudation in the peritoneal sac, and many minute hæmorrhages into the intestinal portion of the membrane.

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[1] *Loc. cit.*

Lauenstein,[1] on the other hand, considers that irrigation is theoretically better than sponging, although he acknowledges that in practice he has not found the procedure attended with good results. He thinks that as much damage may be done to the peritoneum by determined sponging as by the irrigator, and in this he is no doubt right.

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[1] German Surgical Congress, 1888.

Into the peritoneal cavity of three corpses Pölchen introduced some fæcal matter fifteen minutes after death. He employed immediate irrigation, and found that the material adherent to the bowel after the operation was sterile.

When flushing is employed so much fluid remains behind that some sponging becomes necessary.

Other things being equal, irrigation involves more time than the mopping out of the serous sac.

Stuehlen[1] is among the comparatively few recent writers who consider that irrigation can efficiently cleanse the peritoneum.

Kinscherf[2] has carried out a series of experiments which add an additional feature to this subject. He points out that a considerable quantity of fluid may be absorbed by the blood during irrigation, and that the amount may be such that the absorptive power of the peritoneum may be reduced to *nil.* He repeated Delpet's experiments, and irrigated the abdominal cavity of an animal for ten to twenty minutes, with a .6 per cent. salt solution. He then introduced more sulphate of strychnia than was sufficient to produce tetanus in a control animal of the same weight. No effect followed.

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[1] "Die Drainage des Peritoneums," Wurzburg, 1890.

[2] *Loc. cit.*

Kinscherf used a 1 in 2,000 corrosive sublimate solution after the flushing process, and found that no symptoms of poisoning followed, although toxic phenomena were always produced when irrigation had not been previously carried out.

It is, of course, a matter of question, how far experiments such as these can be used as arguments *ad hominem*, but of the unsatisfactory results which have followed upon the indiscriminate use of irrigation after operations in man there can be no doubt. In not a few instances it would certainly appear that irrigation has hastened death.

Drainage.—It will be allowed by most that drainage is necessary, when either an actually noxious material is left in the peritoneal cavity, or when it is assumed that an extensive effusion will follow upon the laparotomy. Considerable differences of opinion must exist as to what constitutes, either in substance or in amount, a noxious material, and also to what extent a possible effusion is to be met by drainage. There seems little to commend the employment of a glass drainage tube passed into the fundus of Douglas' pouch. I have ceased to use this appliance, and it would not appear that it is used with any frequency by the majority of those who are much concerned in abdominal operations.

A stout rubber drainage tube of large size and well fenestrated, passed into the midst of the area which is the most disturbed, appears in most cases to answer all reasonable purposes. It is not suited for most tuberculous cases, and has, in many instances, been followed by an obstinate sinus. In any case the sooner the tube can be removed the better. It must be assumed that the surgeon has no objection after the operation to frequent, and perhaps extensive, changes in the patient's position, for the purpose of assisting the process of drainage. I have myself seen no harm arise from a liberal fulfilment of this object. In certain instances, some of which I have already indicated—a gauze drain appears to be better adapted for the case than a rubber one. This drain is simply composed of a long strand of iodoform gauze about one and a half inches wide, and some five to six layers thick. It appears to have been first advocated by Bardenheuer. In a case of purulent peritonitis, Jalaguier[1] has passed these strands of gauze in all directions among the intestinal coils from the diaphragm to the pelvis with good result.

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[1] *Bull. et Mem. de Soc. de Chir.*, 1891, p. 800.

A like proceeding in like cases is advocated by Steinthal.[1]

The great objections to the iodoform drains are these. They may induce symptoms of poisoning if very extensively employed, they are most difficult to remove unless there be a free discharge, and their use is apt to be followed by ventral hernia. Iodoform tampons used to close a breach in the peritoneum which cannot be closed by sutures, involve much distress in their removal and if left in for a few days may become quite covered in with lymph. If retained long enough to ensure a complete occlusion of the peritoneal cavity, their removal is not so difficult, but a hernia is almost inevitable. The so-called Mickulicz drain is an open bag of iodoform gauze which is stuffed with strips of the same material. It is used when an actual cavity has to be drained, and the size of the tampon is often alarming. The bag is slowly evacuated, piece by piece after the first forty-eight hours, and by the fifth or sixth day it is empty and the gauze sheet itself is then removed. The cases must be few which call for the employment of this formidable tampon.

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[1] German Surgical Congress, 1888.

Some surgeons, either to supplement or to replace drainage, allow the wound to gape, or support it merely by a few quite loose sutures.[1] This measure has been especially advocated in the treatment of perforative or purulent peritonitis.

In conclusion, it only remains to be said that the surgical treatment of peritonitis has not yet reached a position which is either satisfactory or secure. There has been no lack of boldness in the measures used, and little sense of discouragement at the results obtained. Surgical enterprise has been directed against effects and against damage done, rather than against causes and the beginnings of evil. The surgeon holds the same position in regard to peritonitis which was held some thirty years ago in regard to wounds, and more accessible forms of inflammation. At that time he dealt only with the consequences of pathological wrong-doing, just as now he concerns himself with the prevention of troubles which he has learnt to control. Peritonitis will be more successfully treated when measures can be directed against the sowing of the wind rather than, as now, against the curbing of the whirlwind.

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[1] Mickulicz, *Deutsch. Ges. für Chir.*, 1889, p. 303; and Krecke *Munch. med. Woch.*, Aug., 1891.

LECTURE IV.

The Treatment of Tuberculous Peritonitis.

THE interest which has of late years been taken in tuberculous peritonitis is almost unbounded, and as a result the literature of the subject has attained to dimensions which are nearly as limitless.

Few diseases exhibit more curious problems in pathology, more protean aspects at the bed-side, or more strange revelations of the unexpected than does the common affection now under consideration.

Into the morbid anatomy and clinical manifestations of tuberculous peritonitis it is impossible to enter in these lectures except to allude very briefly to a few matters which bear upon the subject of treatment.

No age is free from tuberculous inflammation of the peritoneum. It appears to be most common between the ages of 20 and 40, while it is also frequently met with in children.[1]

It is curious that authors are not agreed as to the influence of sex in the production of the trouble. Some say it is more common in males and others in females. Statistics obtained from *post-mortem* records appear to show that tuberculous peritonitis is more often met with in males, while the list of cases treated by operation show that the majority of the patients operated upon are females.[2] The latter circumstance has been explained by the fact that in women the peritonitis often starts from the pelvic organs and presents itself in a form which suggests and encourages operative treatment; whereas in males the condition is apt to be more general and to be associated with primary tuberculosis in a less favourable position or to appear in a form less suggestive of operation.

The **clinical phenomena** follow no uniform course and are susceptible of infinite variation. Sometimes the trouble begins acutely with rigor and fever attended by digestive disturbances, irregular bowels, colicky pains, and the local manifestations of peritonitis. Certain cases have in their early symptoms resembled typhoid fever. In an isolated example or so the first manifestations have been mistaken for those of perforative peritonitis.

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[1] Osler, *John Hopkins Hosp. Reports*, *Baltimore*, 1890.

[2] Helmrich, Basel, 1892. See also Kœnig, *Central. für Chir.*, 1890, p. 657, and Wagner, *Deutch. Arch. f. Klin. Med.* 1884, bd. 34.

In the great majority of instances the onset has been quiet and stealthy. There is some disturbance in the function of the stomach and intestine, some trifling colic, a steady swelling of the abdomen, and above all a steady wasting. There is irregular fever and a marked fitfulness in all the symptoms. Constipation alternates with diarrhœa, and vomiting may become a notable symptom. In the course of the disease remissions, and relapses, and periods of unaccountable improvement are common, but in spite of any hopeful signs there is a general evidence of losing ground and of undoubted declining.[1]

The abdomen becomes considerably swollen and may exhibit almost every possible gradation and combination of tympanites and dulness of percussion. More or less exudation is usual, and this may be general or may be confined to one or more districts: the intestines may be matted together into a cyst-like mass, the omentum may be rolled up into a solid ball not to be readily distinguished from a substantial growth. Adhesions may lead to a multitude of curious phenomena discoverable on palpation. Here may be an area of resistance and there a void, here all the manifestations of coils of intestine bound down by bands and fillets, and there the signs of bowel floating free in a thin fluid. There may be the phenomena of abscess on one side of the abdomen and the physical signs of ascites on the other.

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[1] Burghausen, *Mitth. aus der Tub. Polikl.*, Oct., 1892, and Vierordt, *Zeit. f. Klin. Med.*, 1887-88.

It is no matter of wonder that tuberculous peritonitis is very commonly the subject of a mistake in diagnosis.

The curious mimicry met with in this disease has led to the diagnosis of cyst of the mesentery or liver, of tuberculous kidney, of ovarian tumour, of cancer of the omentum or peritoneum, of perityphlitic abscess, of internal hernia, and of fibroma and sarcoma of the abdominal wall. In each of the instances mentioned—to quote no others—an operation has been carried out for the purpose of exploring or of relieving the condition imitated by this fantastic disease.

The **morbid anatomy** of the affection follows, moreover, no more regular lines. From an examination of bodies after death, it would appear that tubercle may reach the peritoneum direct from the pleura, through the diaphragm, or may spread to it from the intestine, or from a tuberculous mesenteric or retro-peritoneal gland, or may have had its starting-point in some tuberculous disease of the female generative organs.[1]

Tuberculous peritonitis may be the only manifestation of tuberculosis, although it is more usually secondary to a like process elsewhere.

In the majority of cases a large quantity of exudation is present, the peritoneum is opaque, it tends to become thickened and the intestinal loops are prone to adhere together, and the adhesions thus formed may be very firm.

The omentum is commonly rolled upwards, and is found adherent to the anterior abdominal wall. Its layers are matted together, and often show extensive tuberculous changes.

The mesentery tends to become thickened, but not to be so shrunken as the omentum. The intestines are usually distended, and the belly markedly and uniformly swollen. The umbilicus is often protruded.

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[1] The pathogenesis of the disease is well dealt with by Borschke, *Virch. Archiv.*, vol. cxxvii., p. 121, and Phillips, Gottingen, 1890

The ascitic fluid present usually shows 3 to 5 per cent. of albumen. It is slightly opaque, greenish yellow, and but seldom blood stained. In this exudation the tubercle bacillus is but rarely to be demonstrated. The fluid may persist after the tubercles have disappeared. Peritoneal effusion may depend upon tuberculous trouble in the retro-peritoneal tissue.

Now and then the mesenteric glands are found to be the seat of extensive tuberculous changes. They are seldom, however, conspicuous in the marked cases of peritonitis. The instances in which they are most prominent are commonly those in which there is either no peritonitis, or but a slight manifestation of it. These glands, when matted together, may form a large single tumour, which has been mistaken for an enlarged spleen or a movable kidney, or they may form many large and independent tumours, or numerous small and isolated glands may be found dotted over the whole of the mesentery. In three cases[1] in adults, the limited glandular tumours have been removed by operation. In one the mass was incised, scraped and drained; in the second case the glands were enucleated, and in the third instance they were removed piecemeal. The first patient died of septic peritonitis, the two latter recovered.

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[1] Quoted by Pic., *These*, Lyon, 1890, and by Pean, *Gaz. Hôpitaux.*

Aldibert[1] records the case of a little boy, aged 6, who presented symptoms of tuberculous peritonitis with ascites. Laparotomy was performed. No peritonitis was found, but numerous tuberculous glands secondary to tuberculous enteritis were met with. The abdomen was washed out and the wound closed. The patient made a good recovery.

Intestinal obstruction is not uncommon, as a result of tuberculous peritonitis, and may depend upon bands, upon the bending or kinking of intestine, upon the agglutination of the bowel loops, or upon intestinal paralysis.

The treatment of tuberculous peritonitis by laparotomy.—The early operations in this form of peritonitis were unintentionally performed. The abdomen was opened under the belief that the patient had an ovarian or other cyst. Tuberculous peritonitis was discovered, the abdominal wound was hastily closed, and to the infinite surprise of the surgeon, the patient recovered.

The well-known case reported by Sir Spencer

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[1] "De la Laparotomie dans la Péritonite Tuberculeuse." *These de Paris*, 1892.

Wells was operated upon in 1862. Somewhat like operations were carried out by Petri, in 1874, and Dorhn, in 1878. Kœnig,[1] in 1884, published three cases of tuberculous peritonitis deliberately treated by laparotomy, and urged this measure as a regular mode of treatment.

In the consideration of the subject of the treatment as carried out at the present time, I cannot do better than adopt the arrangement and utilise the statistics of Aldibert, whose elaborate treatise on the subject forms, without doubt, the most valuable monograph of recent years.

In order that a fair idea may be obtained of the result of surgical treatment under the manifold conditions which tuberculous peritonitis presents, Aldibert classifies the disease under three headings:—

(1) The ascitic form; (2) The fibrous form; (3) The ulcerous form.

(1) *The ascitic form.*—(*a*) When acute and involving the whole peritoneal surface the condition is that of acute miliary tuberculosis. More usually the tuberculous process, although in no way limited within the abdomen, is either (*b*) subacute or (*c*) chronic. In such cases very

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[1] See his paper in *Central. für Chir.*, 1890.

numerous grey granulations, which tend to become confluent, are found all over the inflamed serous membrane. There is abundant ascites. The fluid is citron-coloured, sometimes blood-stained and rarely sero-purulent. No adhesions are discovered, or if any be present they are scanty and insignificant. Lastly the peritonitis may be (*d*) chronic and encysted, the morbid appearances being the same, but the trouble being limited by adhesions.

In general terms it may be said that the clinical features in the ascitic form are marked by malaise, fever, headache, wasting, vomiting and constipation. There is meteorism of the abdomen, which is tender, and which presents evidences of ascites.

(2) *The fibrous form.*—In this variety of the trouble it is apparent that the tuberculous process is moving in the direction of recovery. There is a considerable development of fibrous tissue, and evidences of an inflammation of a robust type. Ascites if present is always slight. The fluid is clear and very rarely sero-purulent.

Two varieties of the fibrous form may be recognised: (*a*) The dry variety. Here tubercles are found disseminated over the whole serous membrane, without ascites and without adhesions. The tubercles are large and are, by their size, distinguished from the nodules of acute miliary tuberculosis. This variety is supposed to represent a particular stage in the progress towards recovery. It is met with just after the absorption of the ascitic fluid—which absorption is a feature in the cases which are ending well—and just before the development of adhesions.

(*b*) The adhesive variety. This is marked by adhesions, which may be general and extensive. The coils of intestine may be matted together by firm bands or a mass of adhesions may spread over the whole of the abdominal contents.

In its clinical aspect the fibrous form is associated with a subacute and insidious onset, with moderate fever, no great impairment of health, the absence of marked vomiting, and constipation alternating with diarrhœa.

It may end in recovery or pass on to the ulcerous form.

(3) *The ulcerous form.*—This form is associated with caseation and the breaking down of the tuberculous products. Three varieties are described. (*a*) In the dry variety, when the abdomen is opened, there is presented a confused medley of intestines matted together and to the parietes, and a serous membrane covered with

yellowish or grey adhesions, thick and infiltrated with caseous deposits in one place and still unchanged tubercle in another. The whole of the intestines may be buried in one fibro-caseous mass. When the adhesions and the attached coils are separated innumerable loculi are made evident. Some contain clear fluid, some caseous material, some a chocolate-like matter, and a few may contain pus. The adhesions are of every possible variety, disposition and density. Here and there two adherent coils of bowel may communicate by a fistulous opening, or there may be a fistula discharging fæces at the navel.

The suppurative variety exhibits precisely the same general changes as the dry form, but there is in addition more or less abundant suppuration which may be (*b*) generalised or (*c*) encysted.

The clinical aspect of the ulcerous form is represented by patients who are wasted and miserable looking, who have probably been long ill, who exhibit a considerable degree of fever, especially at night, who are feeble and the subjects of profuse sweating, together with vomiting and diarrhœa. The belly is large and there are areas of dulness and of resonance, with hard masses in some parts and fluctuation in others.

Aldibert deals with 308 cases of tuberculous peritonitis of various forms treated by laparotomy.

The general results of this measure are presented in the following summary:—

THREE HUNDRED AND EIGHT CASES OF TUBERCULOUS PERITONITIS TREATED BY LAPAROTOMY.

I. **The ascitic form.**

(*a*) Acute cases; 2, both ending fatally.

(*b*) Generalised, subacute; 18 cases, 7 deaths. Mortality 38.8 per cent. Cures 61.2 per cent.

(*c*) Generalised, chronic; 64 cases, 15 deaths. Mortality 23.4 per cent. Cures 73.4 per cent.

(*d*) Encysted, chronic; 65 cases, 7 deaths. Mortality 10 per cent. Cures 80 per cent.

Summary of the 149 *examples of the ascitic form.*

Deaths	31
Improved	3
Stationary	6
Cured	109
	149

Mortality due to operation, 2.6 per cent.

General mortality, 20 per cent.

General percentage of cures, 73.8 per cent.

35.4 per cent. of the total cures can be regarded as complete recoveries.

II. **The fibrous form.**

(*a*) Dry variety; 1 case, which recovered.

(*b*) Adhesive variety; 25 cases, 5 deaths.

General mortality in the 26 cases, 19.2 per cent.

Percentage of cures, 76.9 per cent.

40 per cent of the total number of cures can be regarded as complete recoveries.

III. **The ulcerous form.**

(*a*) Dry variety; 4 cases, 3 deaths.

(*b*) Suppurative, general; 6 cases, 2 deaths.

(*c*) Suppurative, encysted ; 12 cases, 4 deaths.

General mortality in the 22 cases, 40.9 per cent.

Percentage of cures, 59 per cent., of which about one-fourth can be regarded as complete recoveries.

IV. **Tuberculous peritonitis arising from the genital organs.**

Forty-one cases, 14 deaths.

General mortality, 34.1 per cent.

Mortality from operation, 4.8 per cent.

Percentage of cures, 56 per cent.

To the above list of 238 cases, the author adds 70 other cases of tuberculous peritonitis treated by operation, which are published without details. Among these 70 cases are 15 deaths.

General Summary.

Cases treated by operation 308
Deaths 74
Mortality due directly to operation, 2.5 per cent.
Cures 215

Percentage of cures, 69.8 per cent., of which number 33.4 per cent. can be regarded as complete recoveries.

In 50 of the above 308 cases tubercle was demonstrated, either histologically or bacteriologically. Among this number are 7 deaths, 39 cures, and 4 examples of non-improvement.

Indications for operation and methods of operating.

(1) *The ascitic form.*—It is needless to say that operation is contra-indicated in cases in which general acute miliary tuberculosis exists. It has also proved to be of no avail in examples of acute miliary tuberculosis limited to the peritoneum. In the subacute and chronic forms, operation has been attended with good results.

It will be seen that the best effects have followed in the chronic cases, and especially in those in which the peritonitis was encysted. The existence of fever is no bar to operation, and it has not been shown that the laparotomy has caused the tuberculous process to become more diffused about the body. It has been estimated that in the medical treatment of the ascitic forms, 9.5 per cent. are cured, 19 per cent. die, and 71.5 per cent. remain unimproved.

With regard to the method of operating, it has been shown that repeated puncture is of no avail in the great majority of instances. It is uncertain, imperfect, may lead to hæmorrhage, and has led to fatal wound of the gut. Every variety in the method of performing laparotomy has been placed on record. In some, after a simple, free incision with evacuation of the fluid, the abdominal wound has been closed. In other cases the peritoneal cavity has been flushed out, either with sterile water or some antiseptic solution, and the wound then closed. In a third class of case the serous sac has been drained, either with or without a previous flushing. In a fourth series the peritoneum has been treated with some drug, such as iodoform, iodine solution, or solution of carbolic acid, or of corrosive sublimate.

In the cases of generalised peritonitis the best results have followed simple incision, without either flushing or drainage. The cases treated by irrigation show 72.5 per cent. of cures; those not irrigated show 74.3 per cent. of cures.

Drainage is not necessary, and indeed drainage of the whole cavity is impossible. Relapses are as common in the cases drained as in those not drained. The gauze drain is better than the rubber tube. Fistulæ have been somewhat common after the use of the tube.

In opening the abdomen it is well to remember that the peritoneum may be considerably thickened, and that the gut may be adherent to it. All the fluid should be evacuated and the peritoneal cavity may, if necessary, be mopped out. Adhesions should not be disturbed, and the omentum, if extensively tuberculous and rolled up, may be excised.

In the encysted form it is desirable that the localised collection should be cut into directly. Irrigation is not called for, and those cases have done best in which no drain was employed. Sinuses are very apt to follow the use of the drainage tube. If any drain be employed it should be of gauze.

In a few cases the wound has given way after the operation, and more fluid has escaped. In other instances fæcal fistulæ have formed, or the wound has become the seat of tuberculous ulceration.

Among the examples of operation in the ascitic forms, there were 14 relapses (in 149 cases); 3 were in children, and these were ultimately cured; 11 were in adults, of these 1 died, 3 remained stationary, and 7 recovered. In the whole series, therefore (149 cases), the percentage of relapses is only 9.4 per cent.

In five of the relapsed cases in adults, a second laparotomy was performed. Of this number 1 died, 2 were cured, and 2 remained unrelieved.

(2) *The fibrous form.*—In the dry variety, operation has not been advised by many, as it is assumed that the case is progressing towards cure. Aldibert, however, urges it. He points out that the laparotomy can do no harm, and that the case—if left alone—may relapse, or pass on to the ulcerous form.

In the adhesive variety operation is seldom called for. The condition is one moving in the direction of cure, and it is the opinion of most surgeons that this form of tuberculous peritonitis may be left to medical measures.

Laparotomy may be carried out if there be much fever, if the health be failing, if suppuration be suspected, or if there be much pain or any symptoms of intestinal obstruction.

The operation is rendered very difficult by reason of the adhesions, which should be handled with the greatest care. The best results have attended incision and irrigation without drainage. If many adhesions be broken down then a drain is called for.

Several cases of fæcal fistula have been noted in connection with operations upon this variety of peritonitis.

(3) *The ulcerous form.*—The operation is considered by most to be contra-indicated in the dry form, and in those examples of the encysted form, in which the pus is pent up in numerous loculi. The complete evacuation of all these collections involves serious and wide-spread damage.

In all other forms of the trouble laparotomy followed by drainage is distinctly to be advised. In the majority of instances recorded the diseased serous cavity has been treated by irrigation.

In these cases the less the adhesions are disturbed the better.

Pic has made the following estimate of the prospects of a patient suffering from the ulcerous variety of tuberculous peritonitis. Of children treated without operation one-third recover, of adults treated without operation one-fifth recover, of cases treated by operation four-fifths recover.

The manner in which laparotomy effects a cure. —This subject has led to considerable speculation, but at present to no completely satisfactory answer. The operation does not act by producing adhesions, since, as a rule, none form. It would not appear to act by exciting a more robust inflammation, for in the majority of cases no such reaction is evident.

Lauenstein has assumed that the beneficial effect is due to the removal of the fluid and the admission of light, and he points out that light and the absence of moisture are hostile to bacteria growth. Cameron suggests that the incision allows of the escape of the ptomaines and toxines, which are produced by the bacteria. Mosetig-Moorhof considers that the main element in the cure is the admission of air into the peritoneal cavity. Nolen holds the same views, and has reported some cases of tuberculous peritonitis which were cured by pumping sterilised air into the peritoneal cavity.

Not a few writers ascribe the good effect of the simple incision to modifications in the state of pressure within the abdomen and to an improved circulation, and a more active absorption, due to some ill-defined re-adjustment of that pressure

It is remarkable that an actual incision appears to be necessary, as repeated observations have shown that puncture of the serous cavity leads but seldom to any improvement.

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